

Horizontal Coherence of Acoustic Field in the East China Sea (Some Preliminary Results)

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Outline of the Talk

- **Introduction**
- **The method used for the data processing on the horizontal received array**
- **Some preliminary result of the data processing**
- **Conclusion(?) And the further work**

Introduction

- The horizontal variant of the ocean can cause the different variant on the delay time of the signal between two sensors, at the same time cause variant on the horizontal coherence.
- Analyze the horizontal coherence and the delay time of the signal may gained some information for the tomography

Introduction

- For analyze the variant of the receive signal data, many undetermined factors affects the process's quality: variant of the array's shape, position, variant of the source's range,etc.
- The relationship between each frequency of the signal (broadband signal process) is often considered as stable, when we try to solve the indeterminations cause by the array's shape,position,range,etc.

Introduction

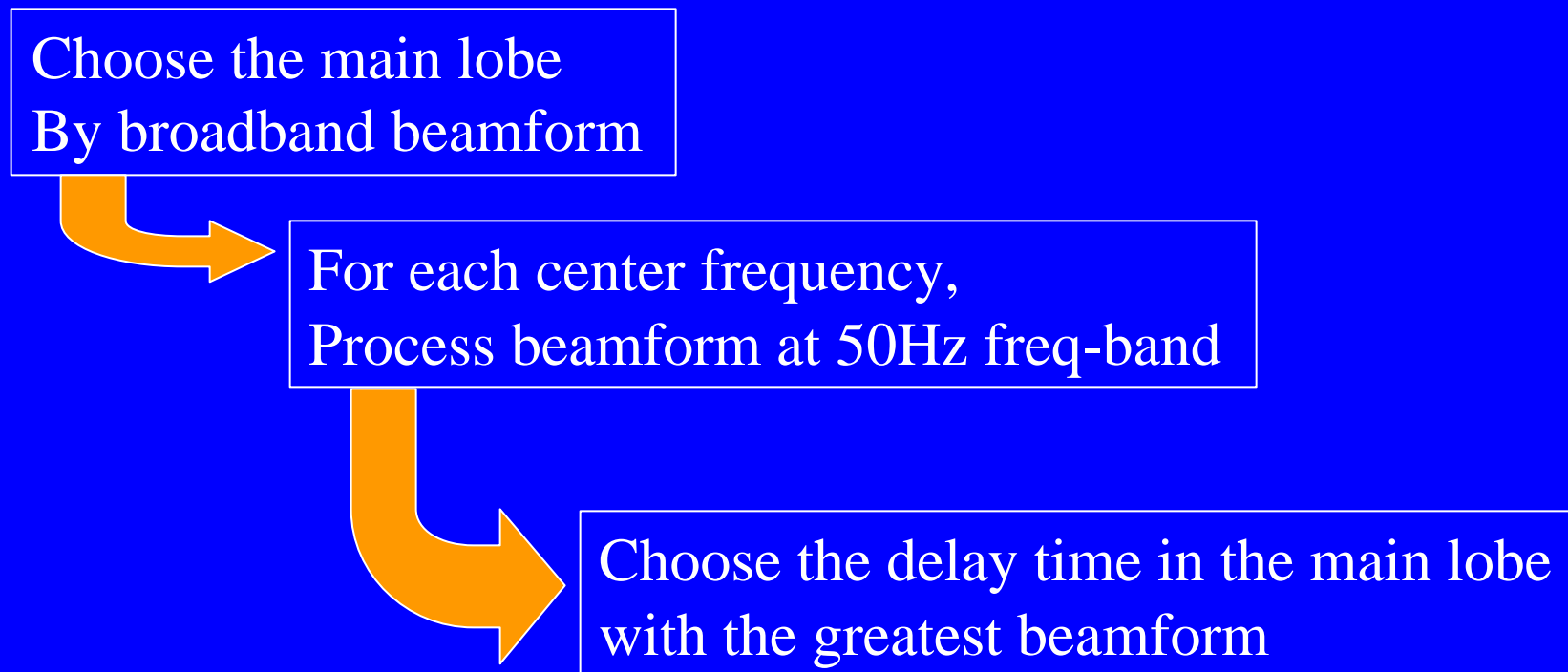
- The data we want to process is received by a flexible horizontal line array, ASIEAX in the east china sea
- 16 receiver sensors, among with 2 sensors fail in the experiment
- 116 groups of explosive signal for the sound propagation (we used for the delay time and the horizontal coherence's estimation)
- The nominal space of the line array is:
- 4.0m,8.0m,..., while in the experiment they fluctuate slightly all the time.

The Method Used for the Process

- **The variant of the shape the array**
 - **Consider the time delay and the coherence between two sensors' data**
- **The grating lobe of the time delay estimation cause by the space great than the half-wavelength**
 - **First calculate the beam forming of the broadband received signal, then search for each frequency**

The Method Used for the Process

- The flowchart of the process



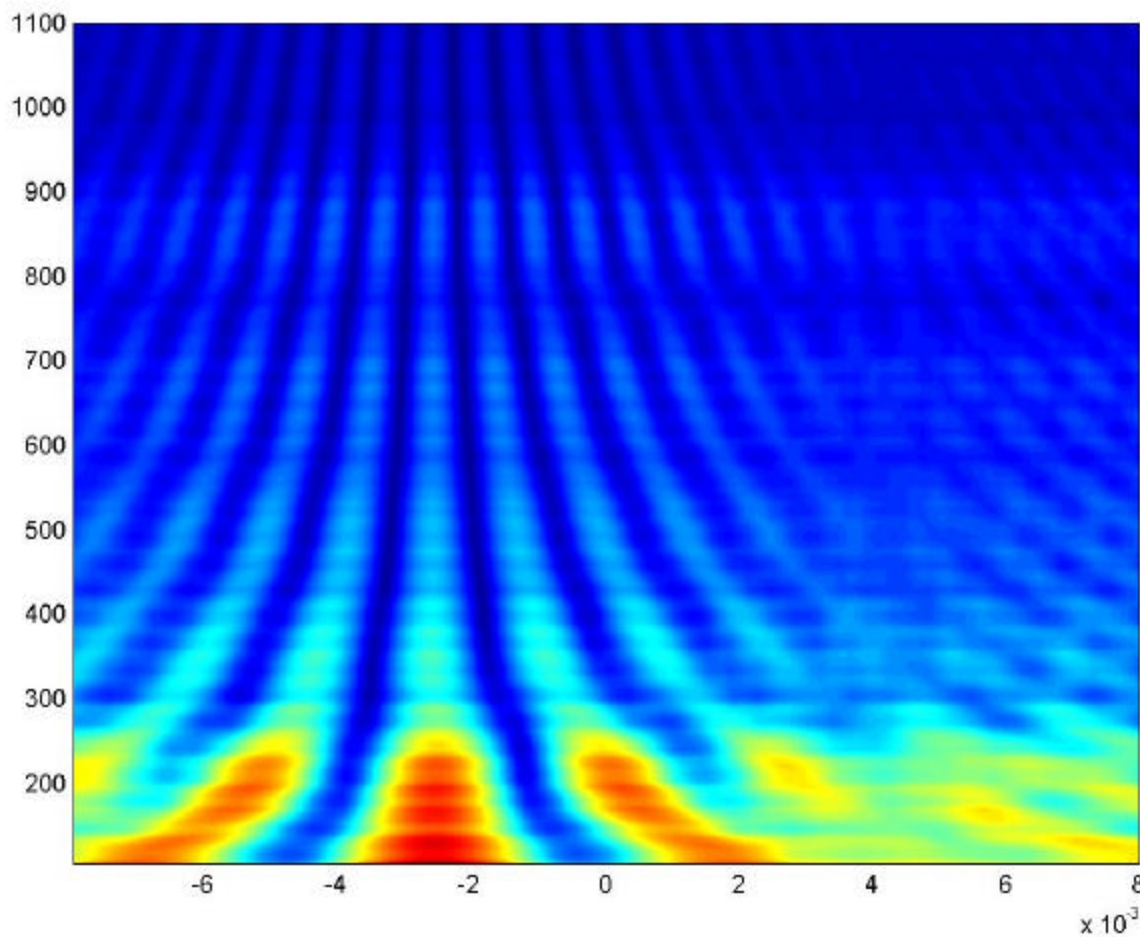
Some Preliminary Result of the Data Processing

- **The beam forming of the signal between no.1 and no.3 sensors**
- **The delay time and the horizontal coherence between no.1 and no.2(no.3,...) signals**
 - **From different range and different space**

Some Preliminary Result of the Data Processing

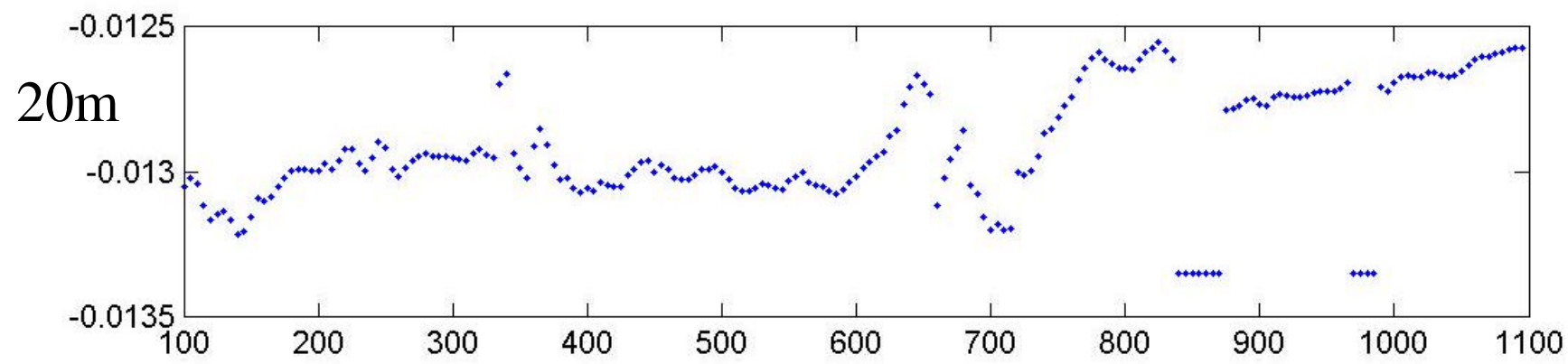
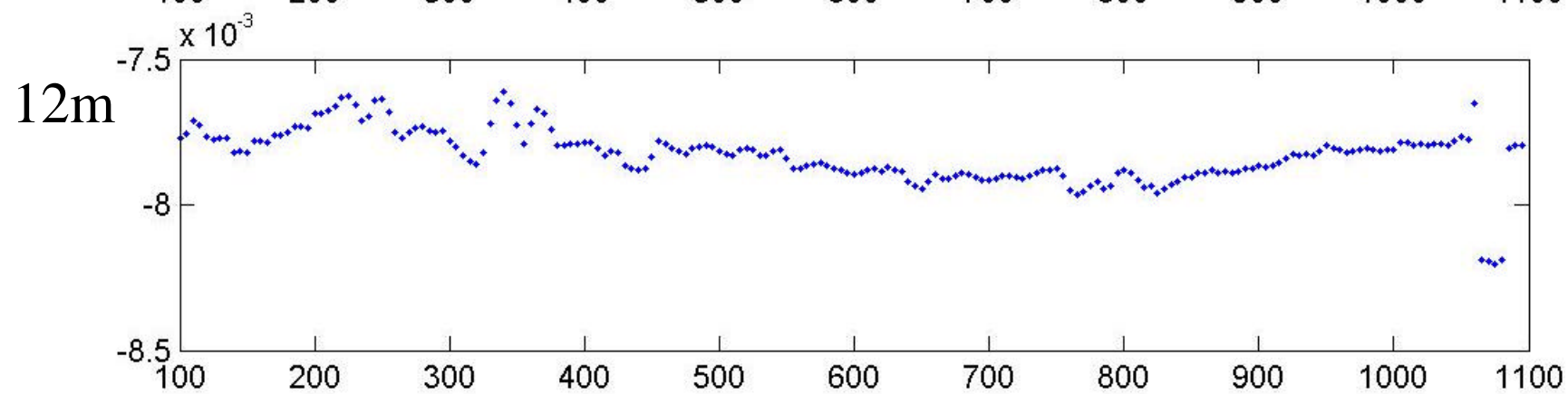
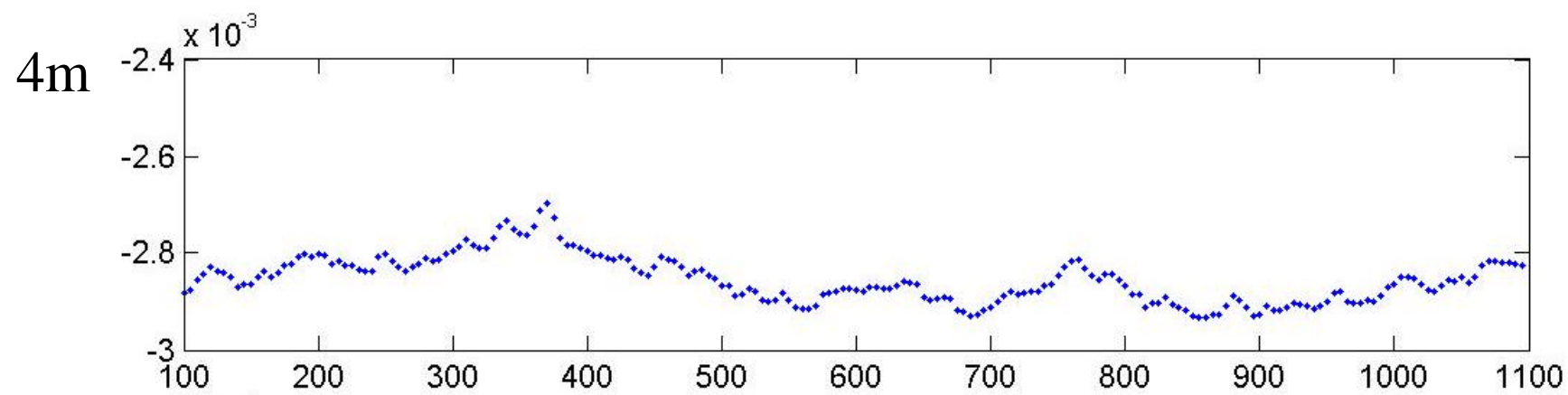
- **Focusing on a signal result on a single range and space for explain the process**
 - **Horizontal coherence for slightly delay time compensate**
 - **Time delay for different center frequency about different sensor space**
 - **Horizontal coherence for different center frequency about different sensor space**
 - **Compare the time delay and the coherence for different center frequency**
 - **The ambiguity (grating lobes) occurred in the time delay estimation**

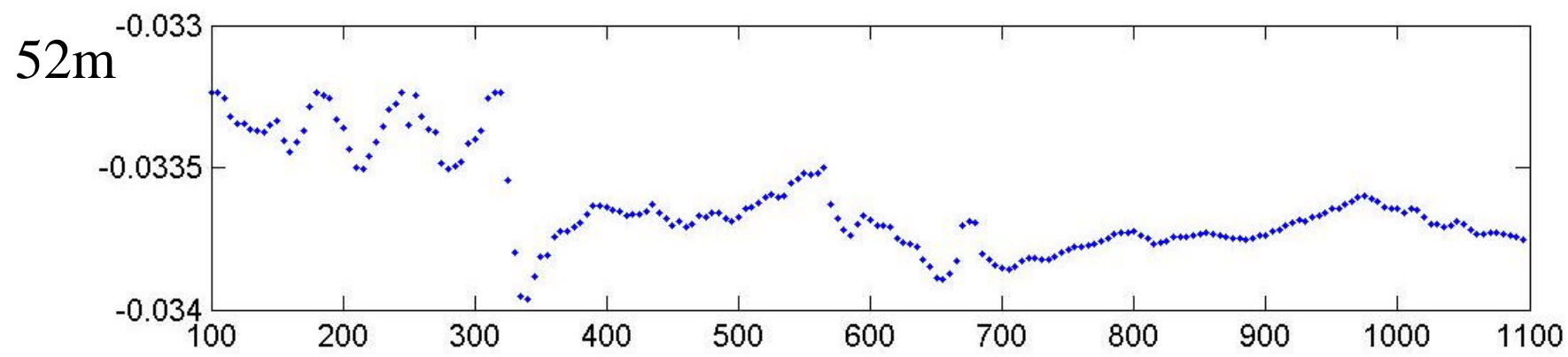
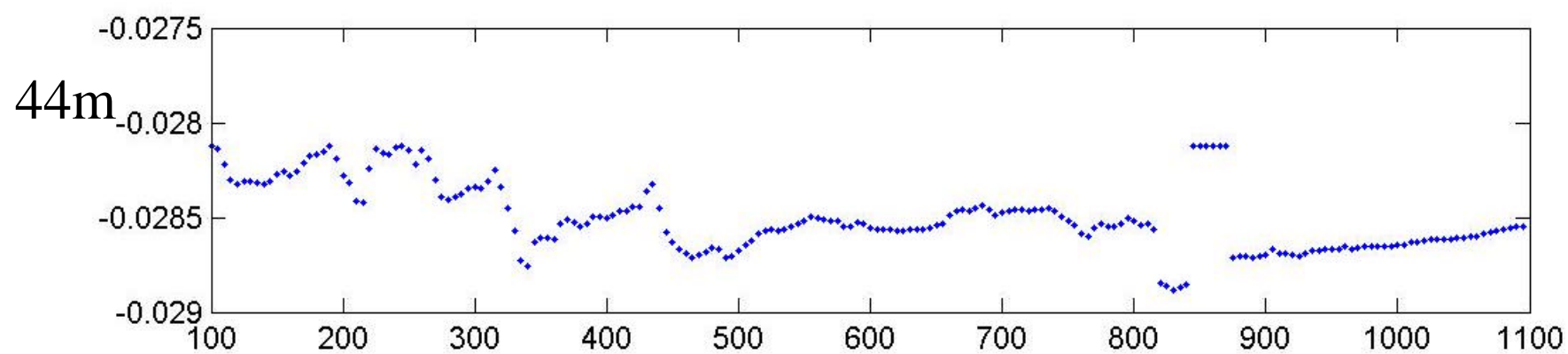
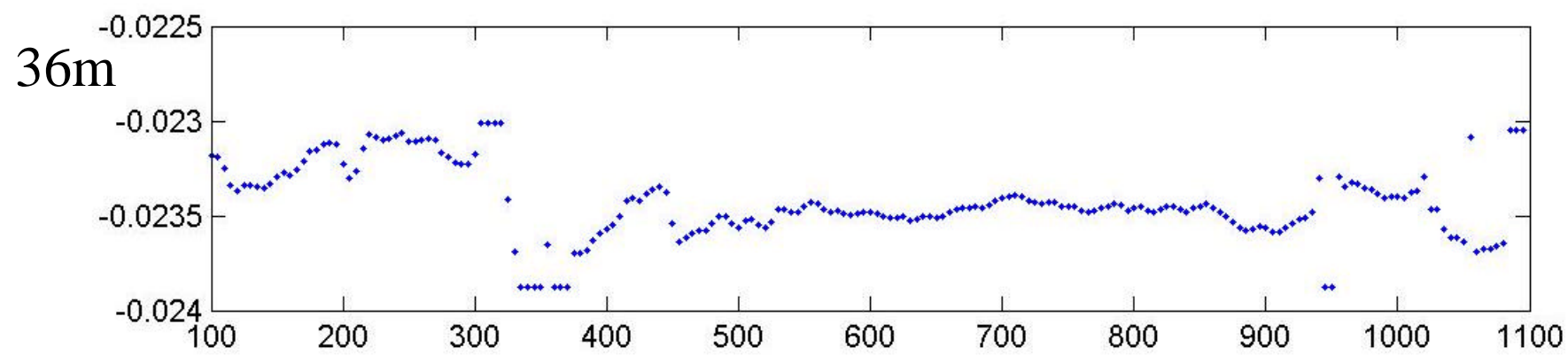
The Beam Forming of the Signal Between No.1 and No.3 Sensors

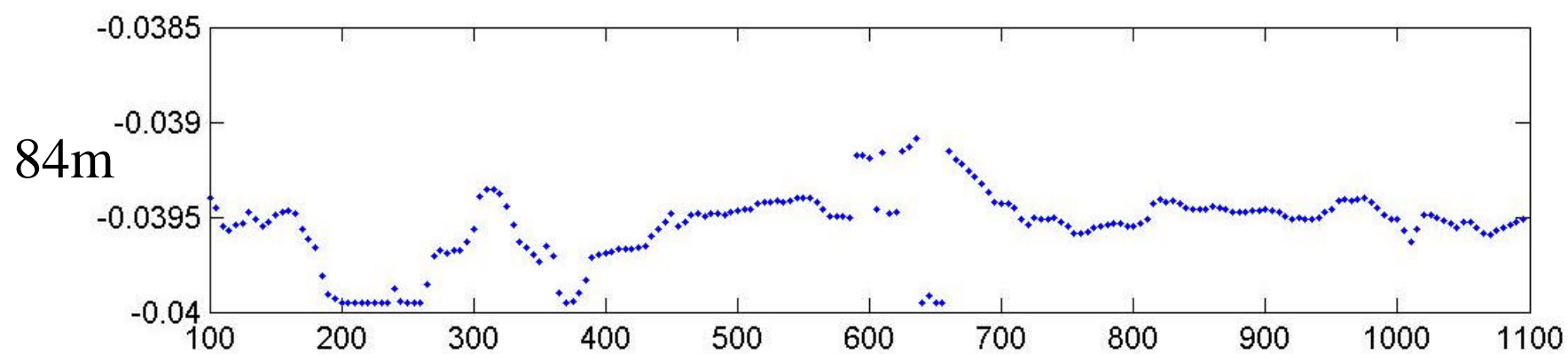
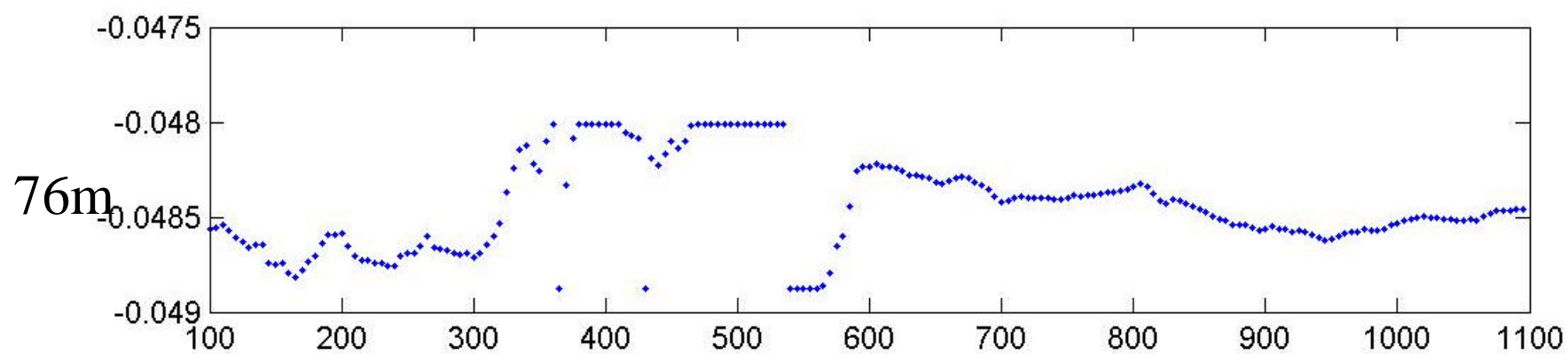
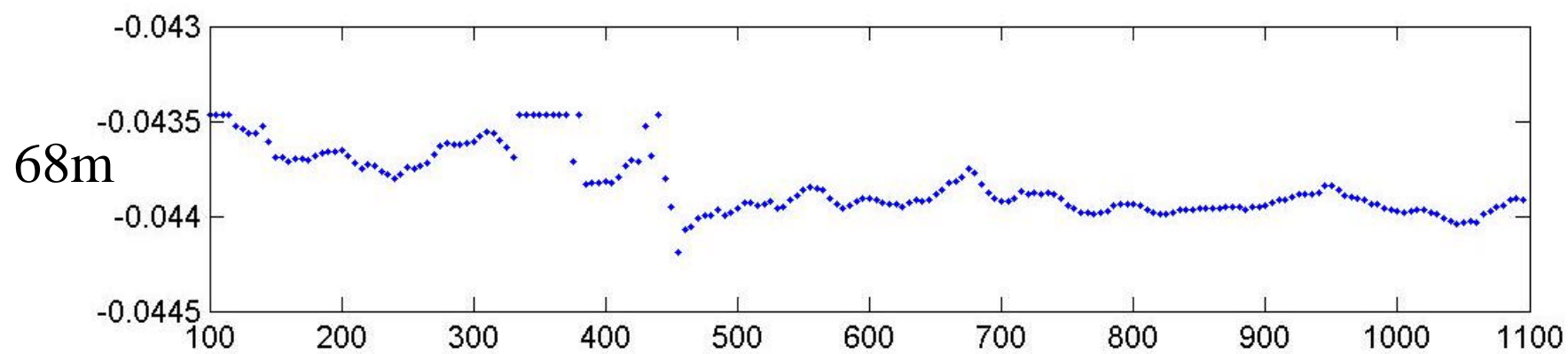


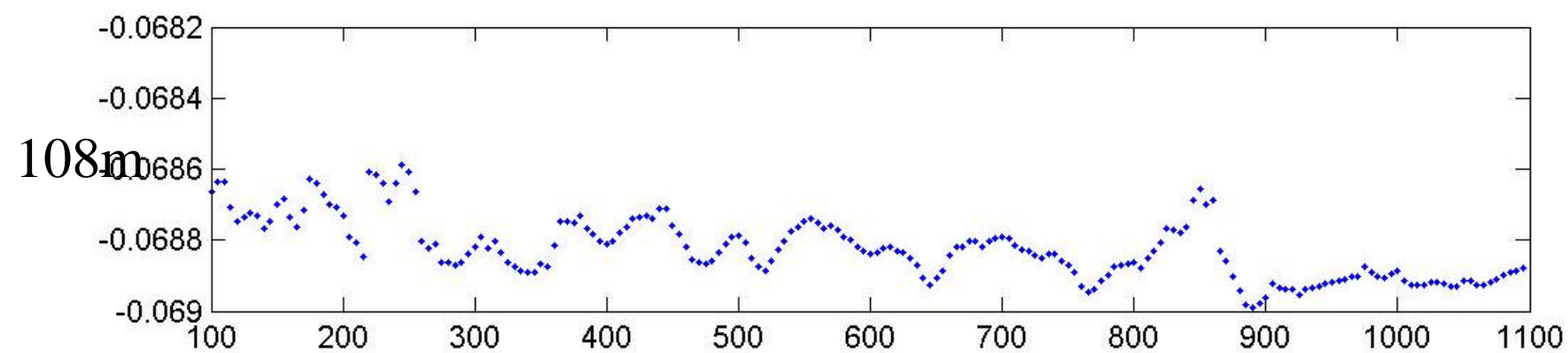
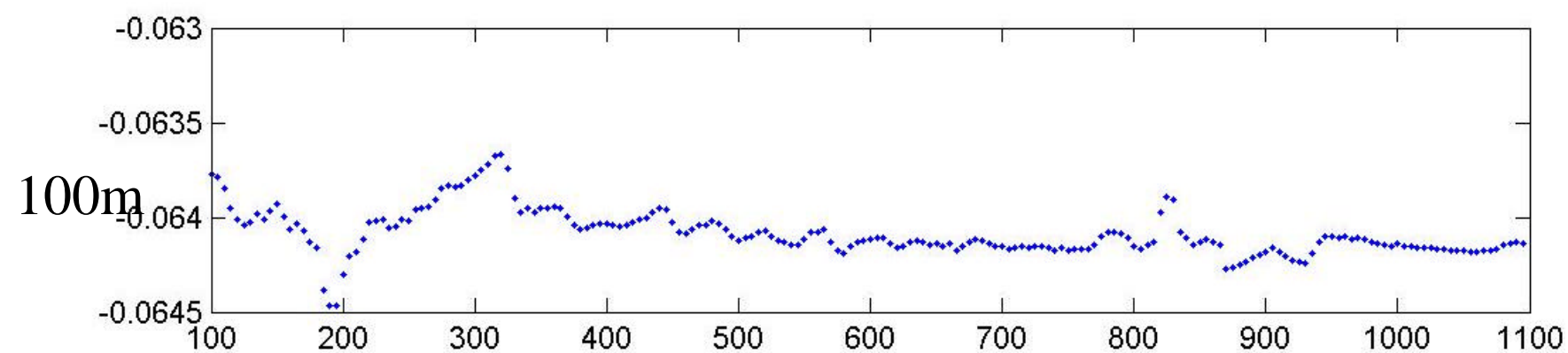
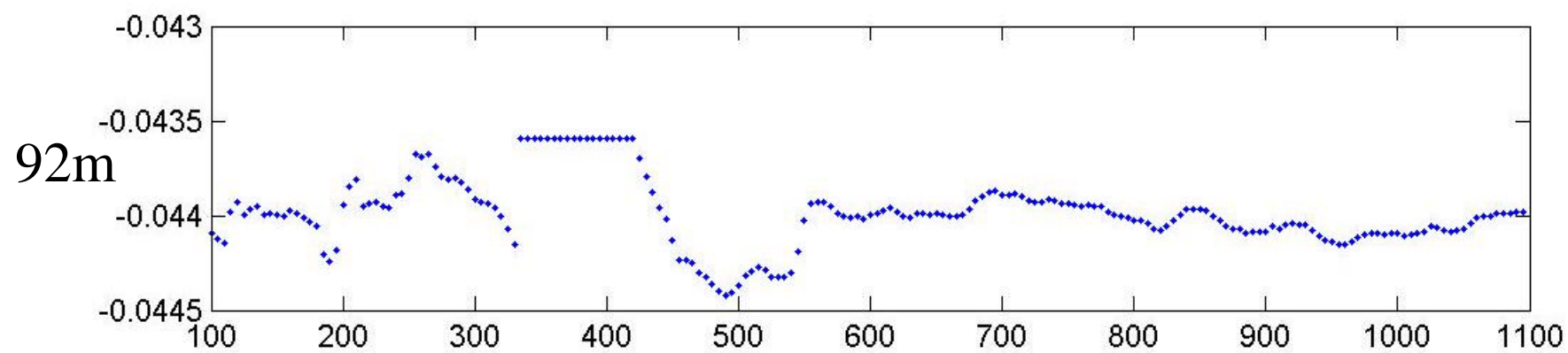
The Delay Time and the Horizontal Coherence

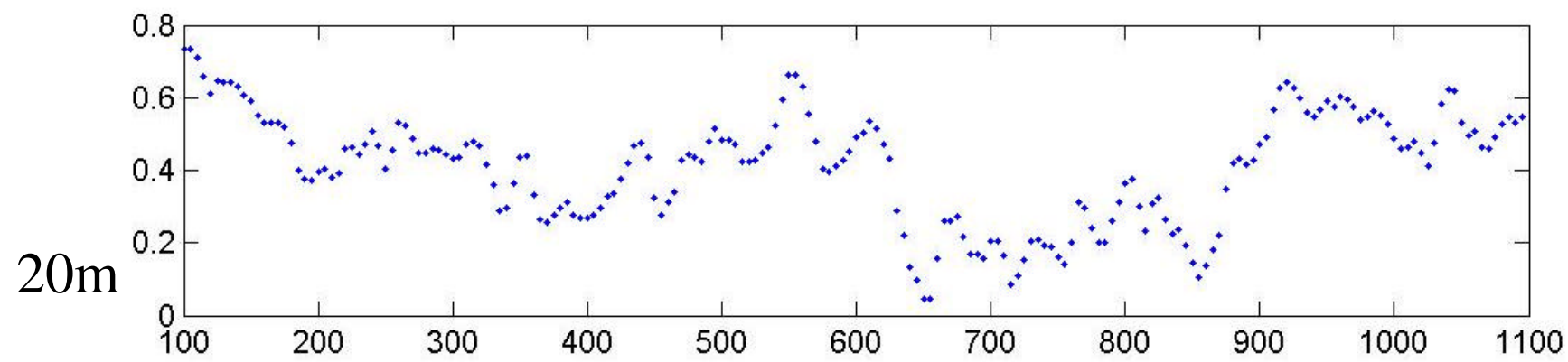
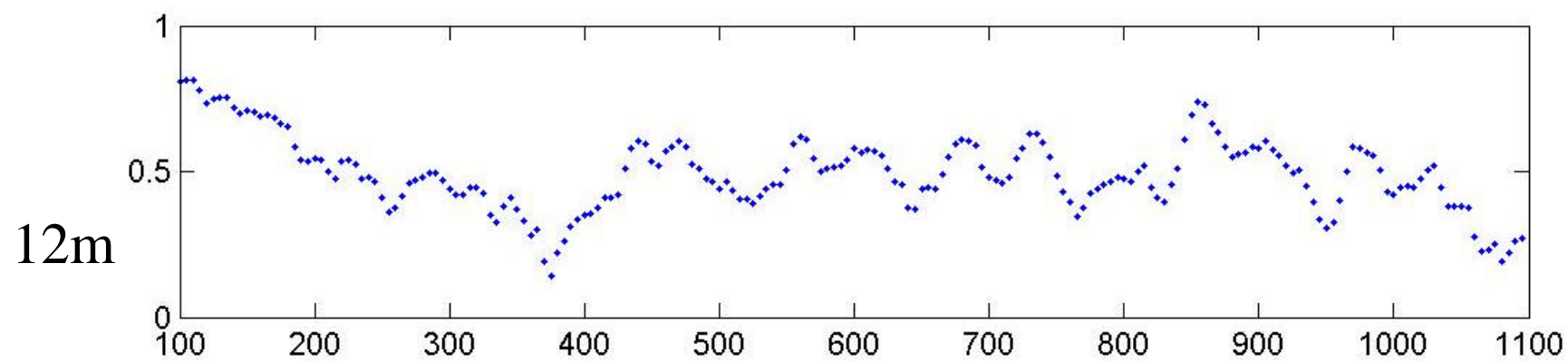
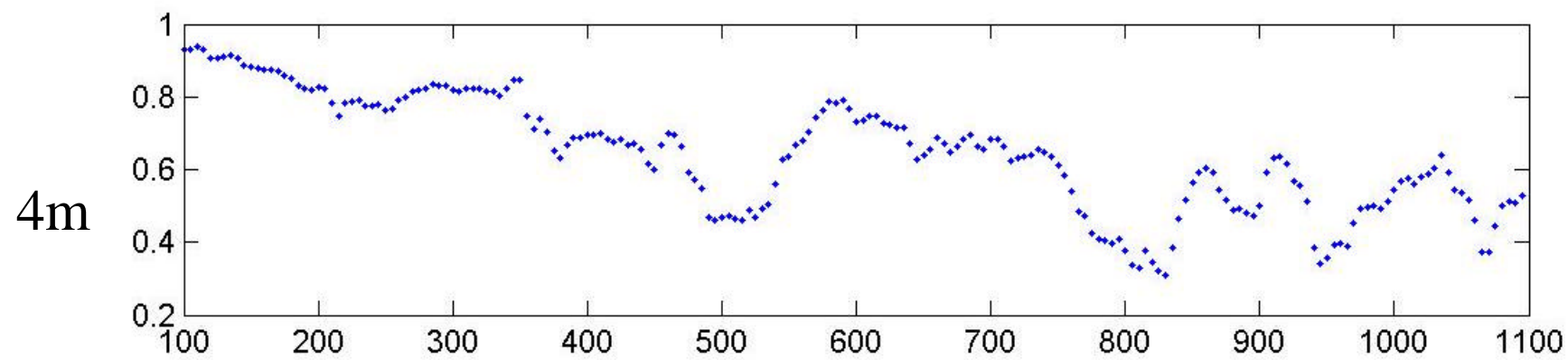
- From different range
 - 3km~30km
- From different space
 - 4m~116m

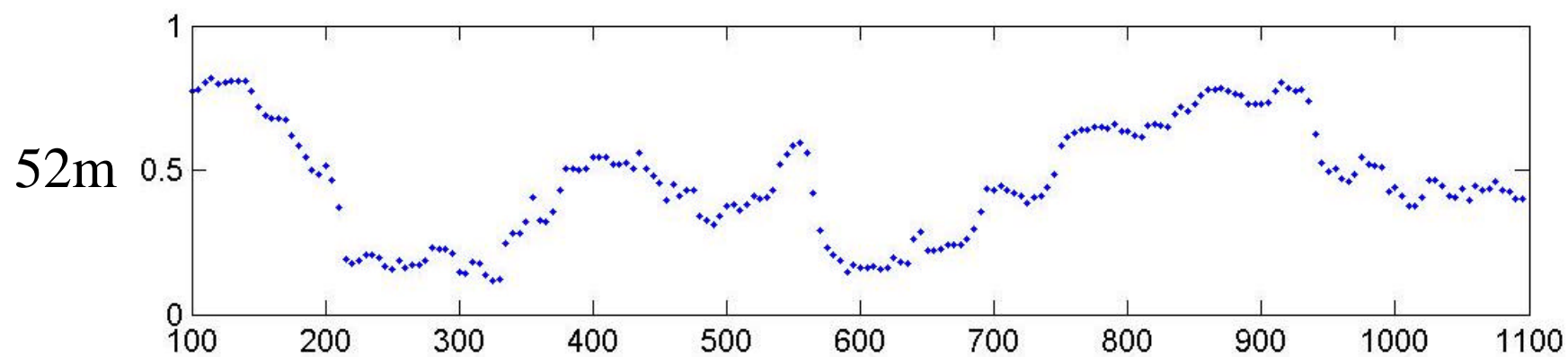
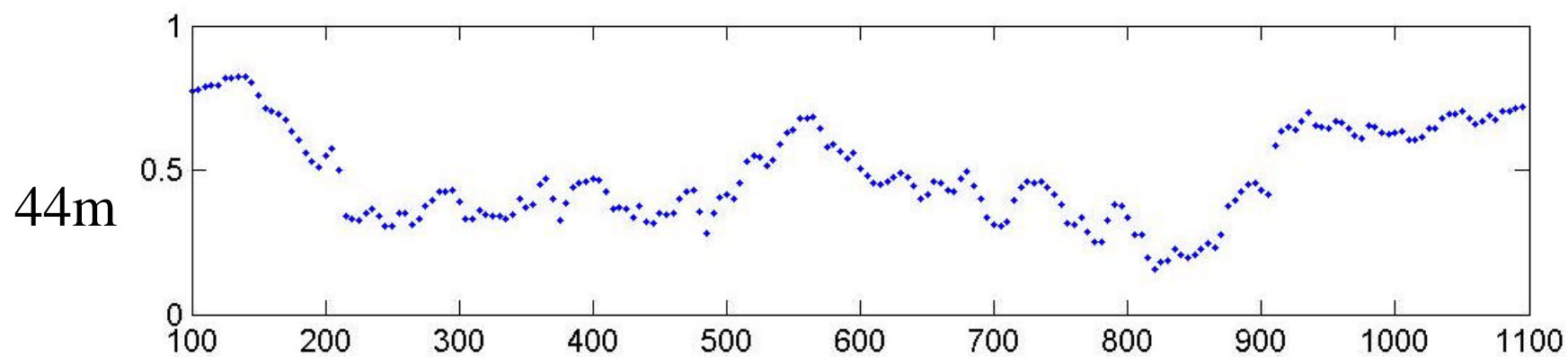
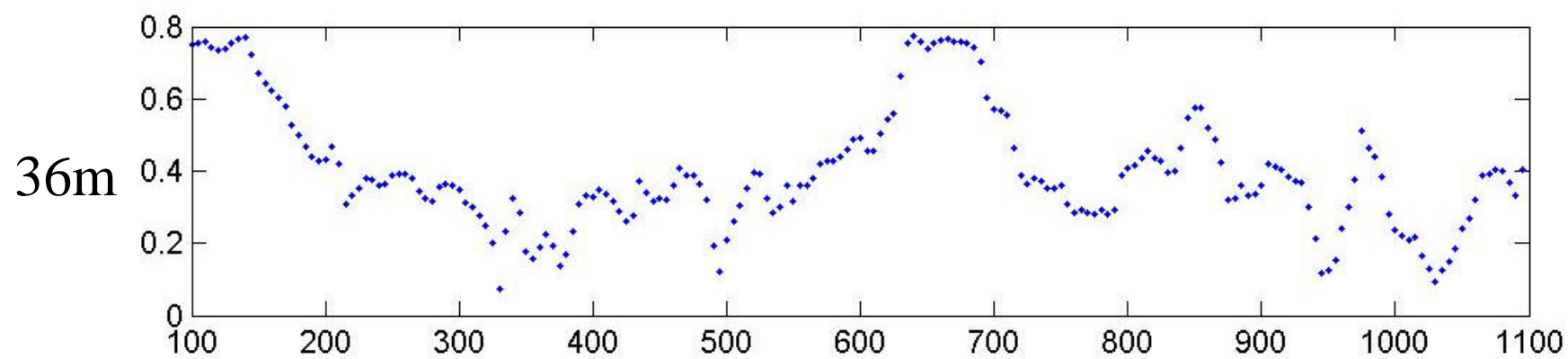




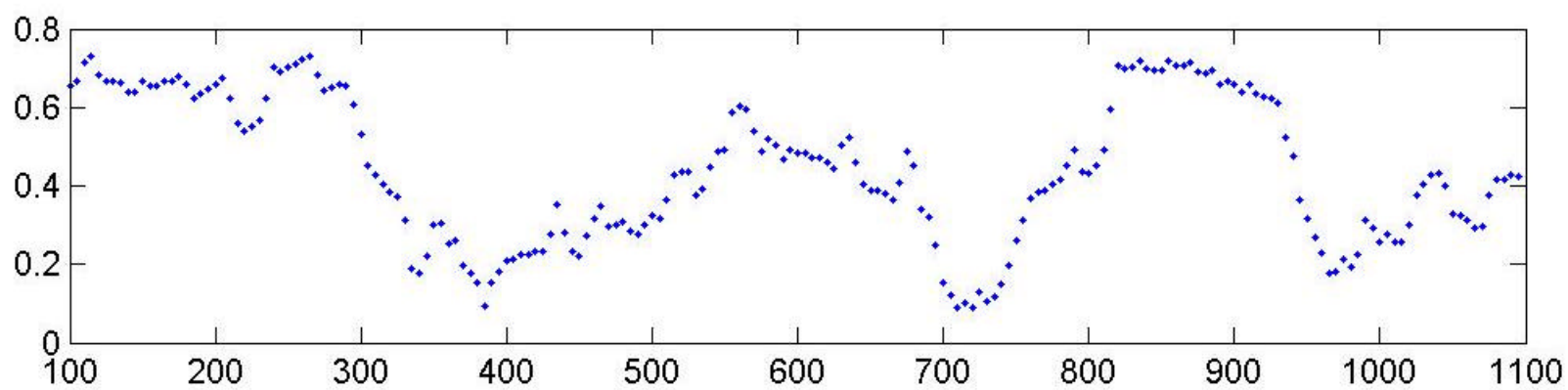




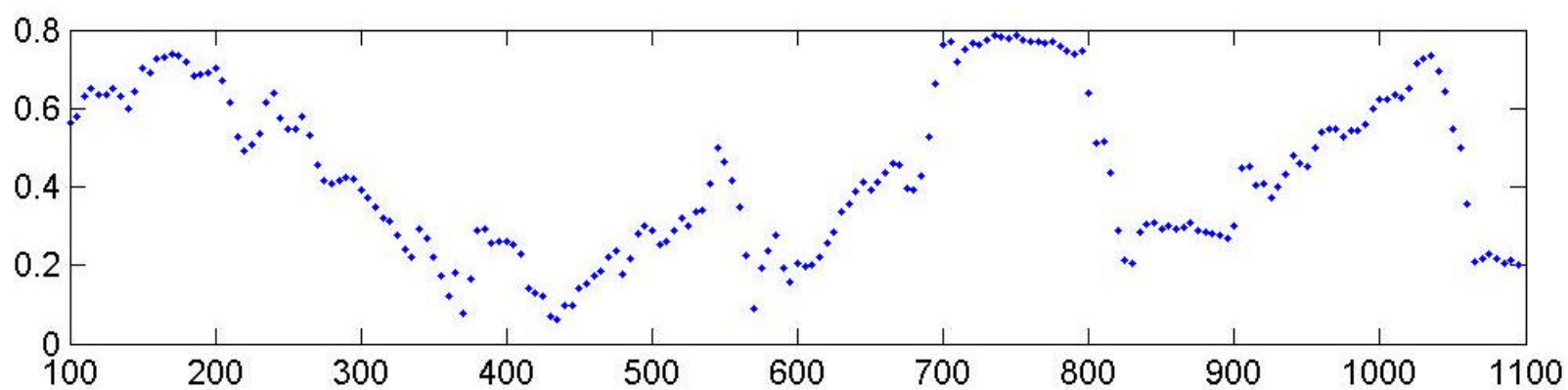




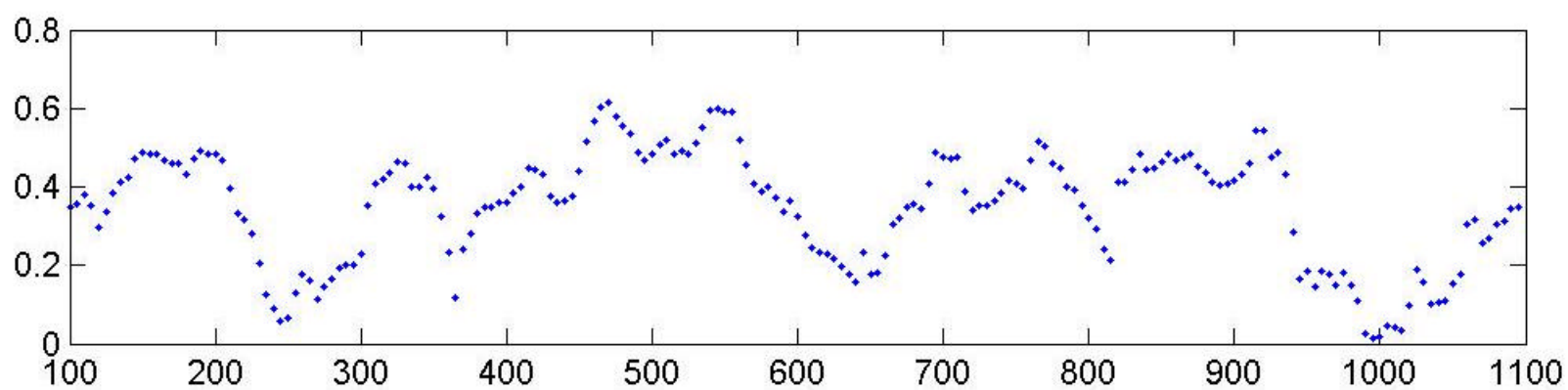
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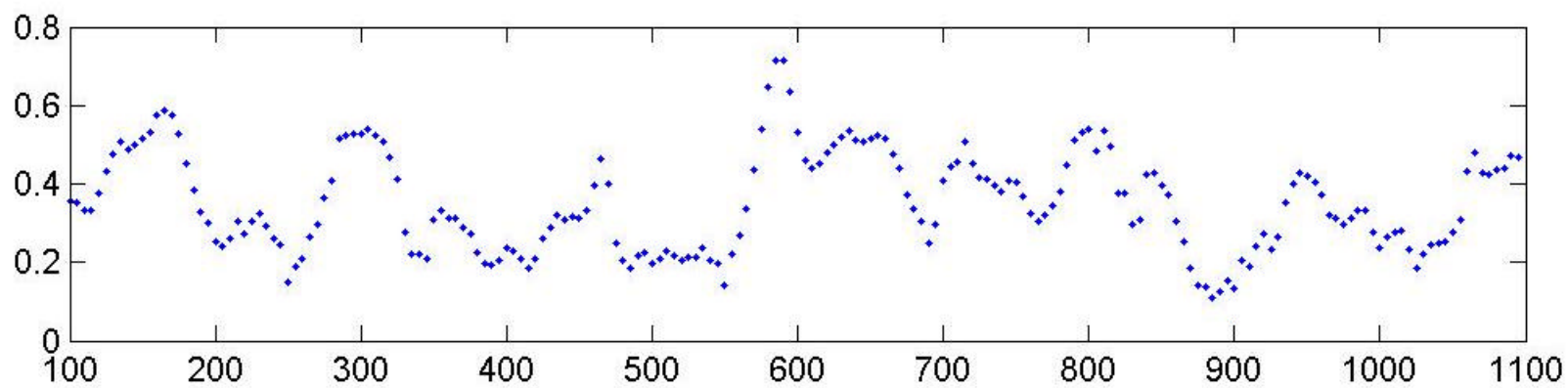
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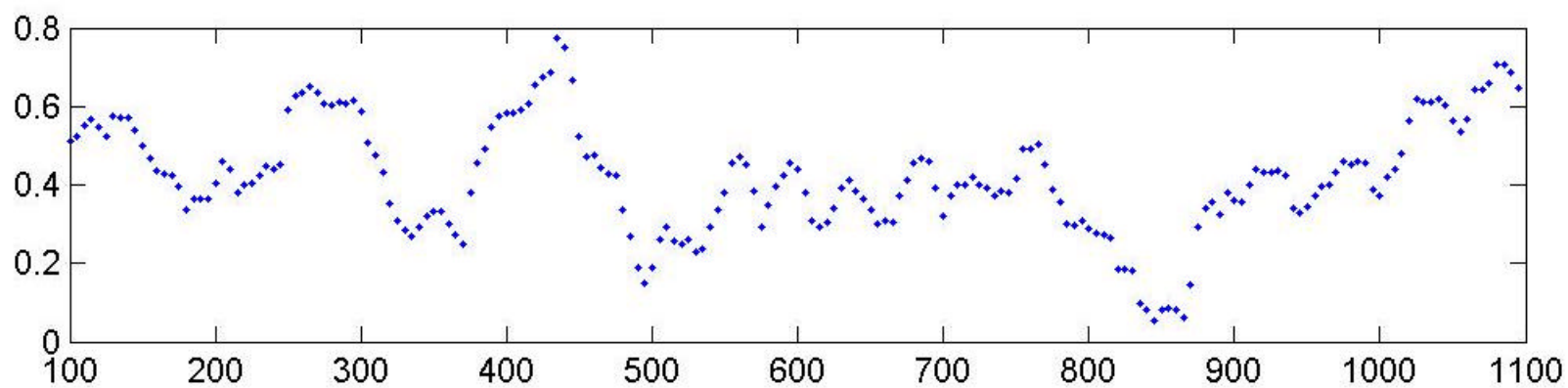
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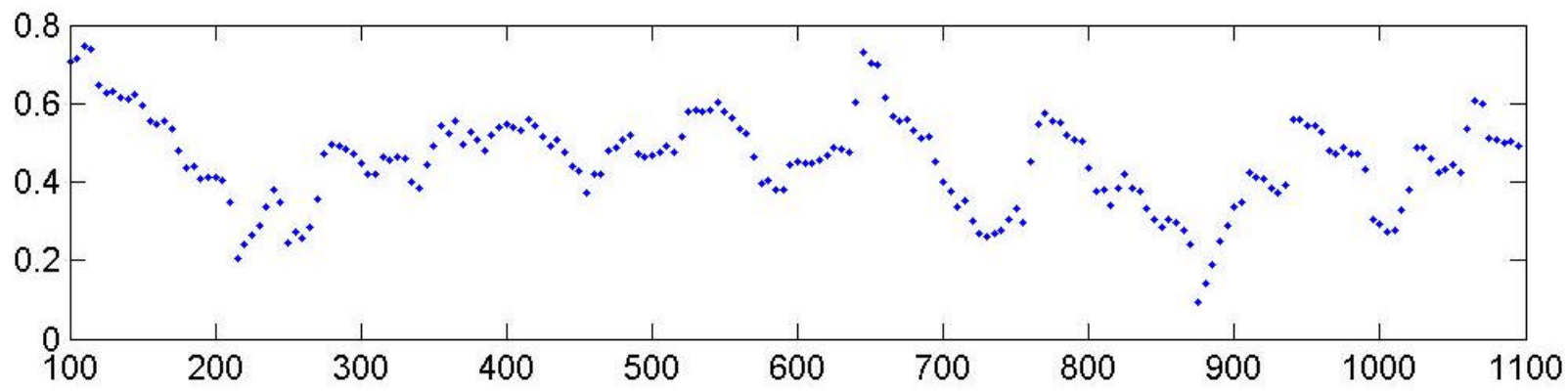
92m



100m



108m

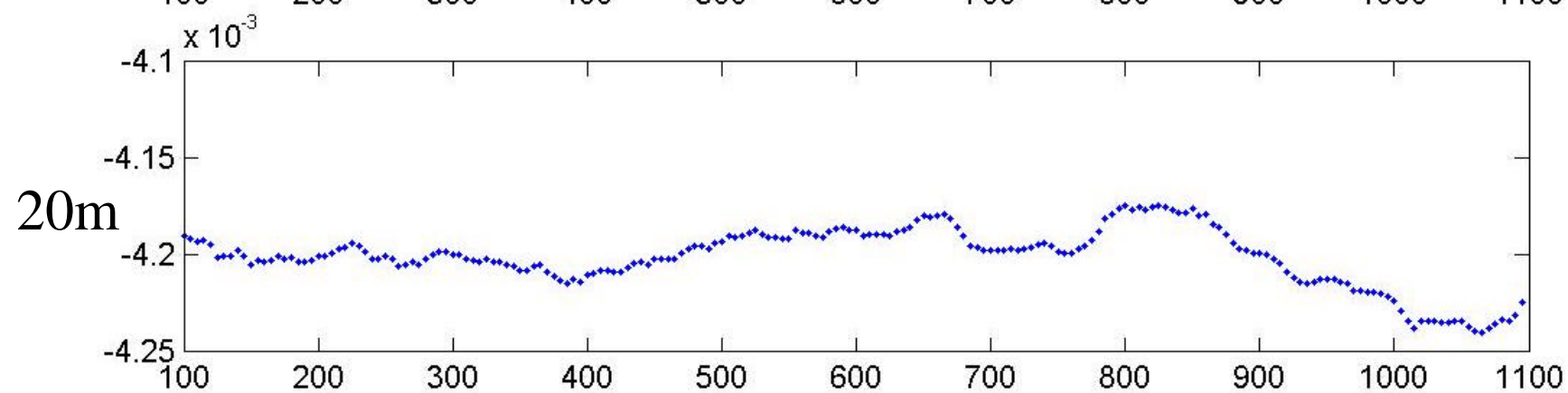
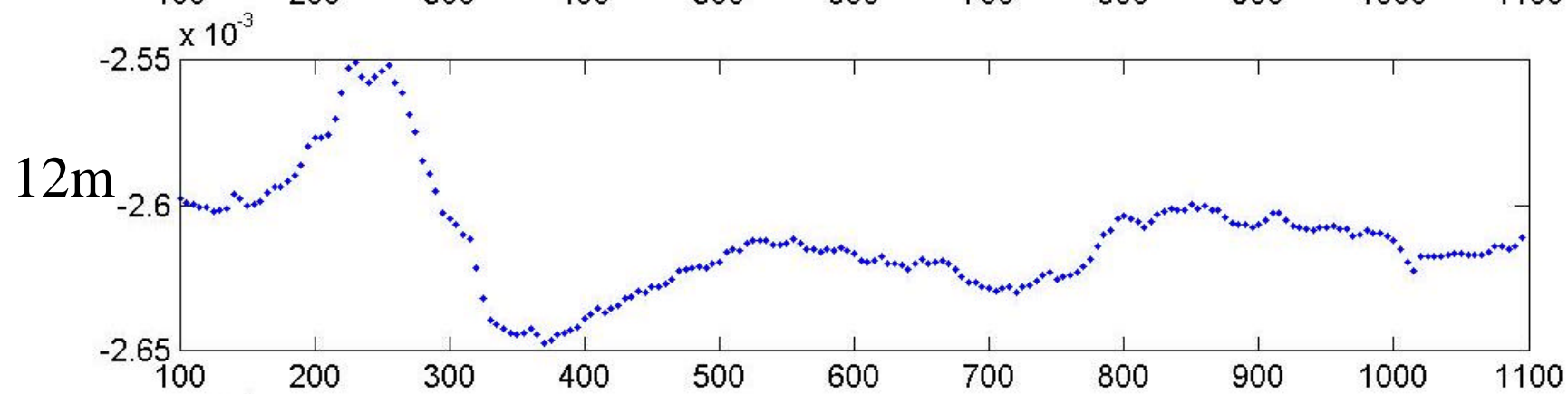
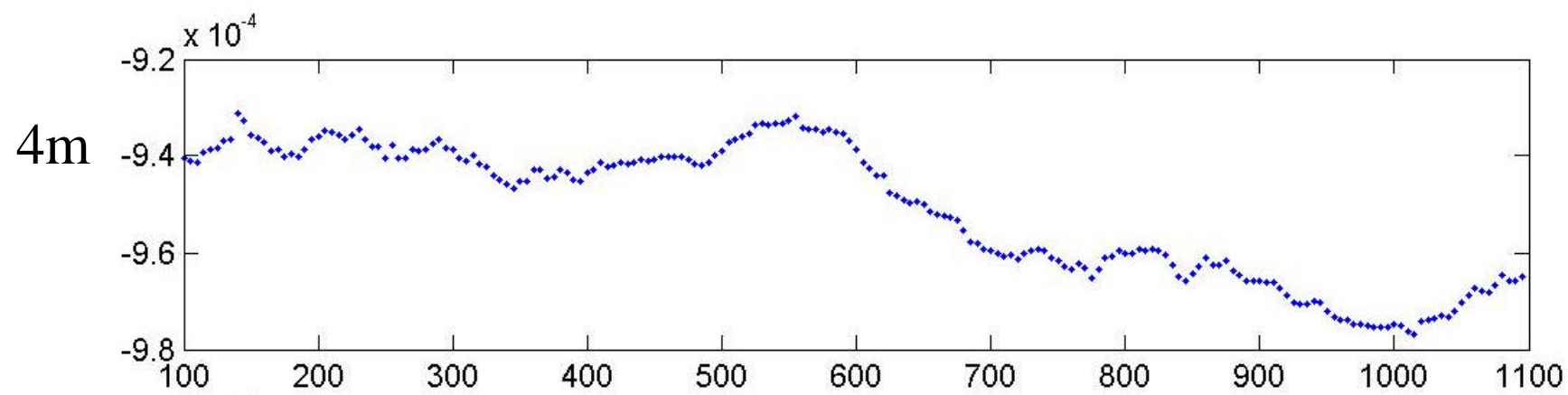


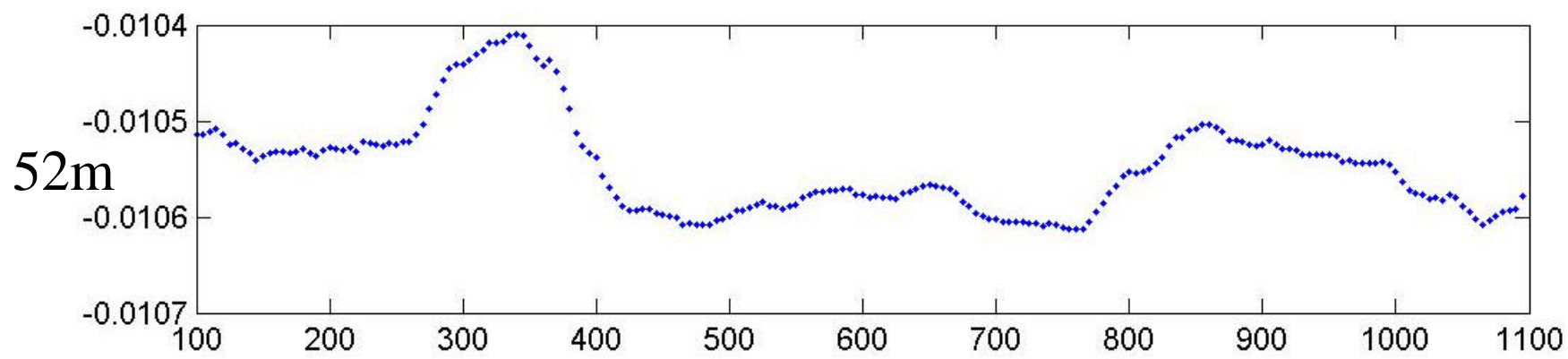
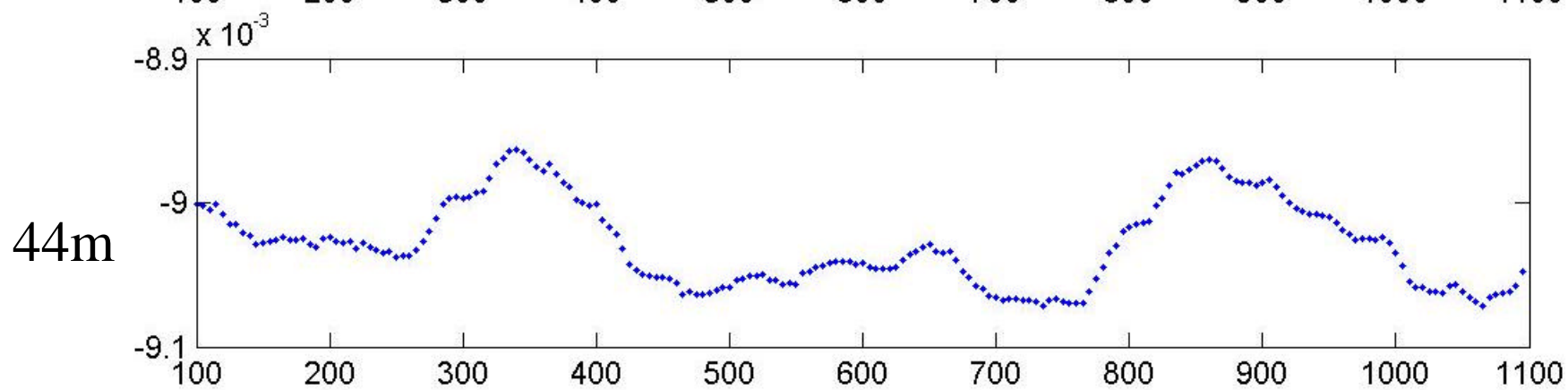
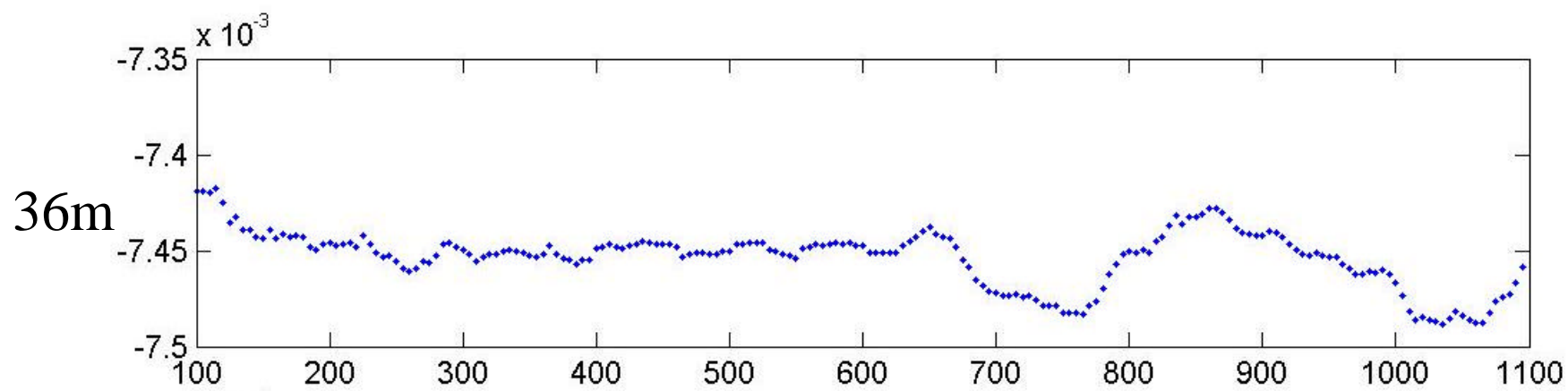
Focusing on a Signal Result on 30 Km

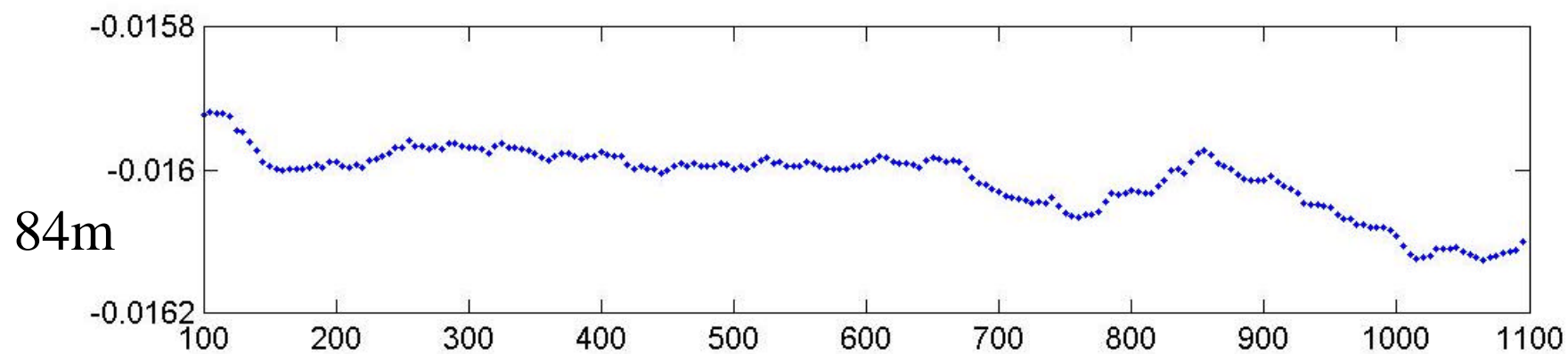
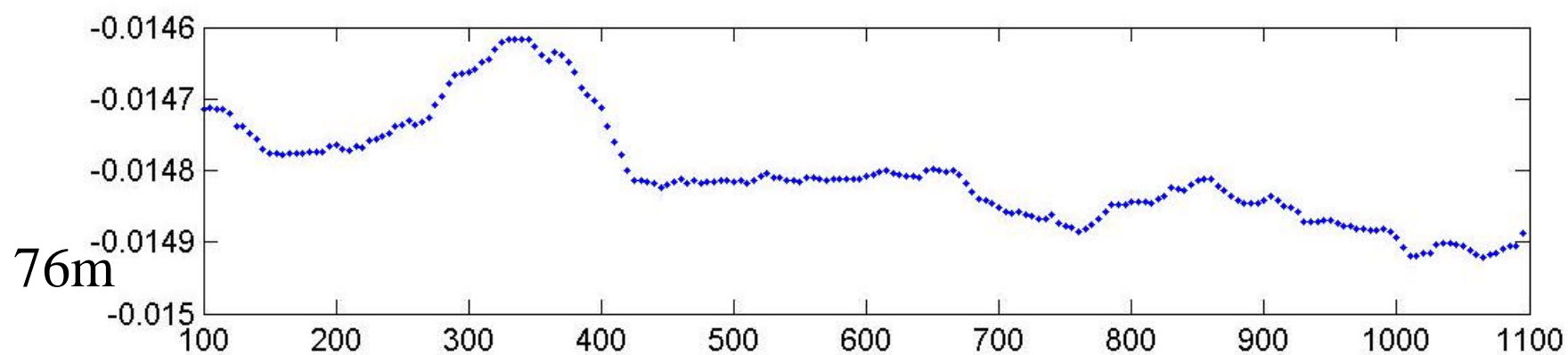
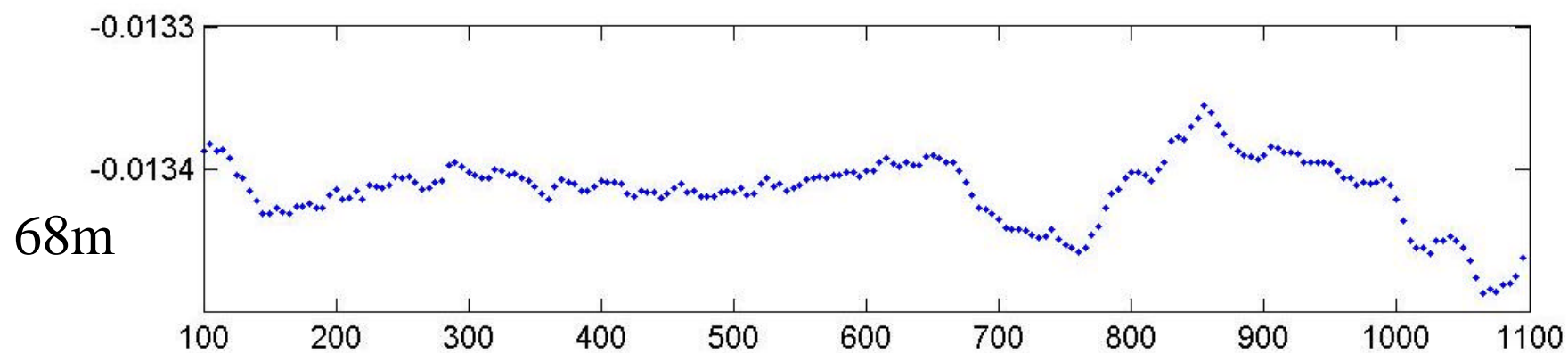
- **Horizontal coherence for slightly delay
time compensate**

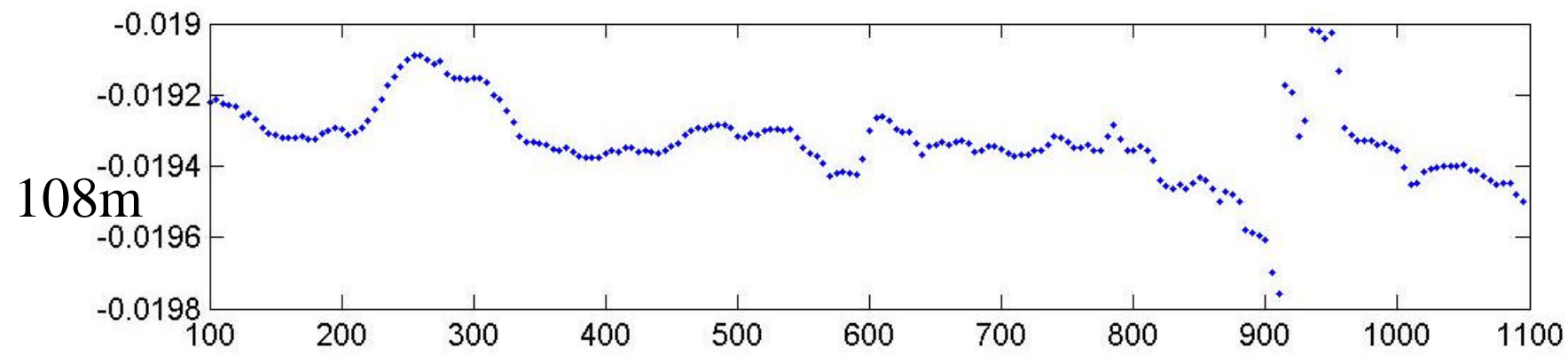
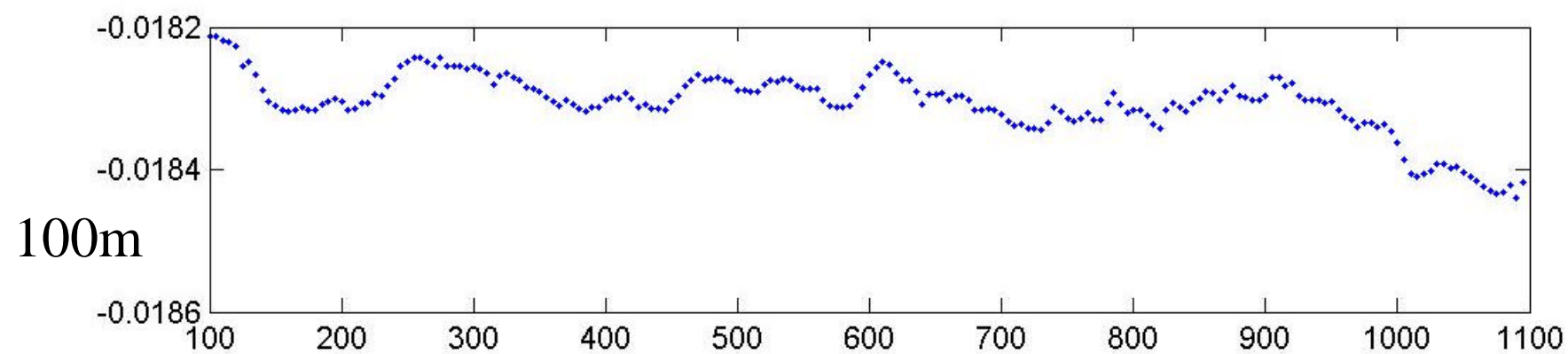
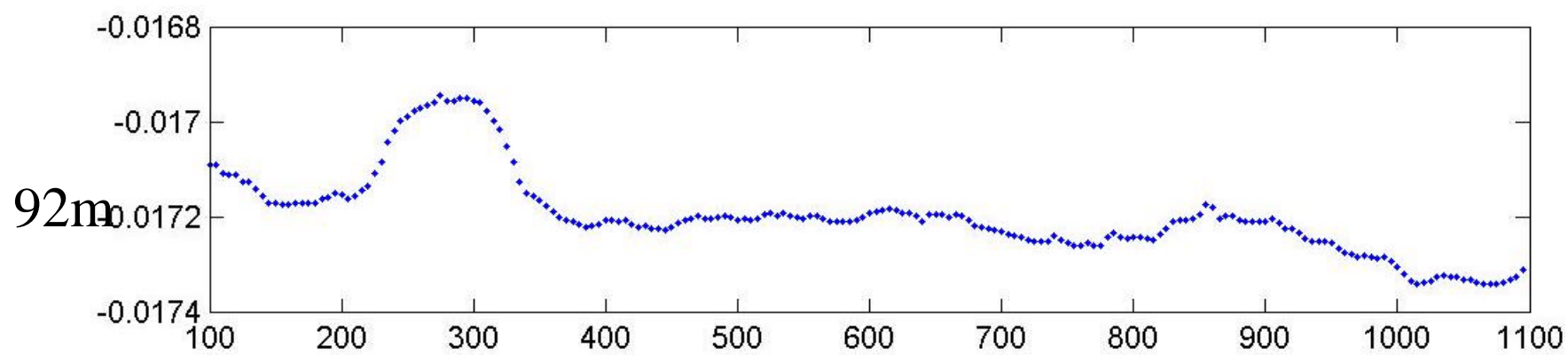
Focusing on a Signal Result on 30 Km

- **Time delay for different center frequency
about different sensor space**



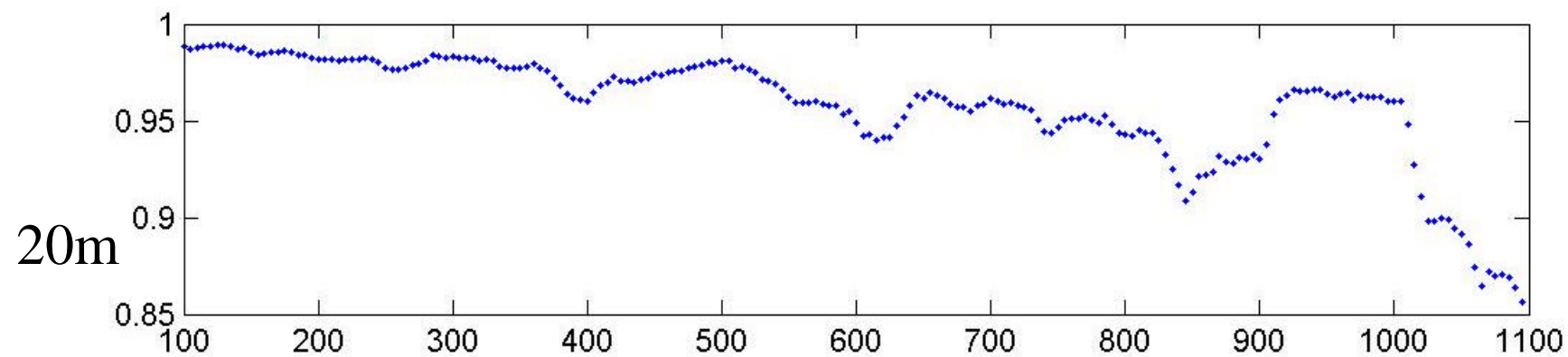
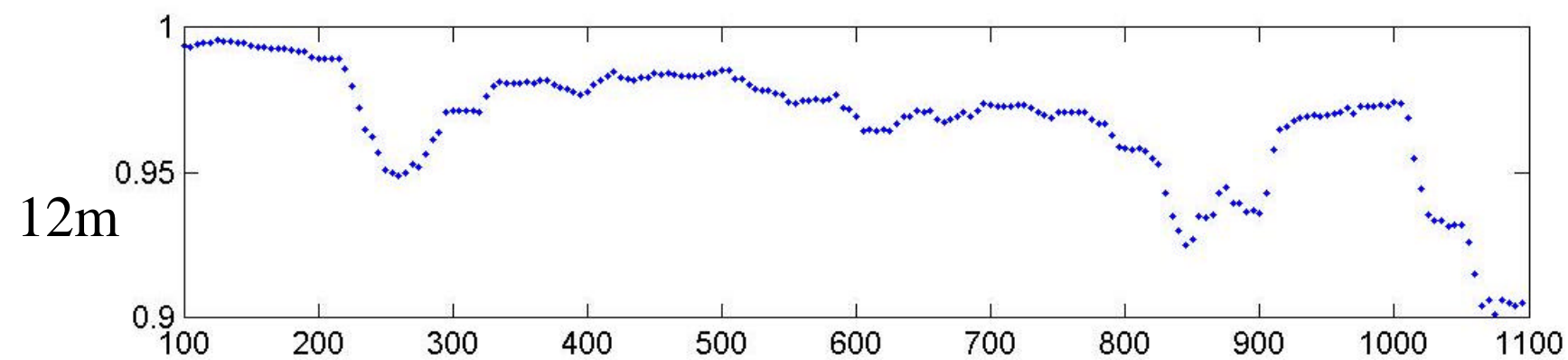
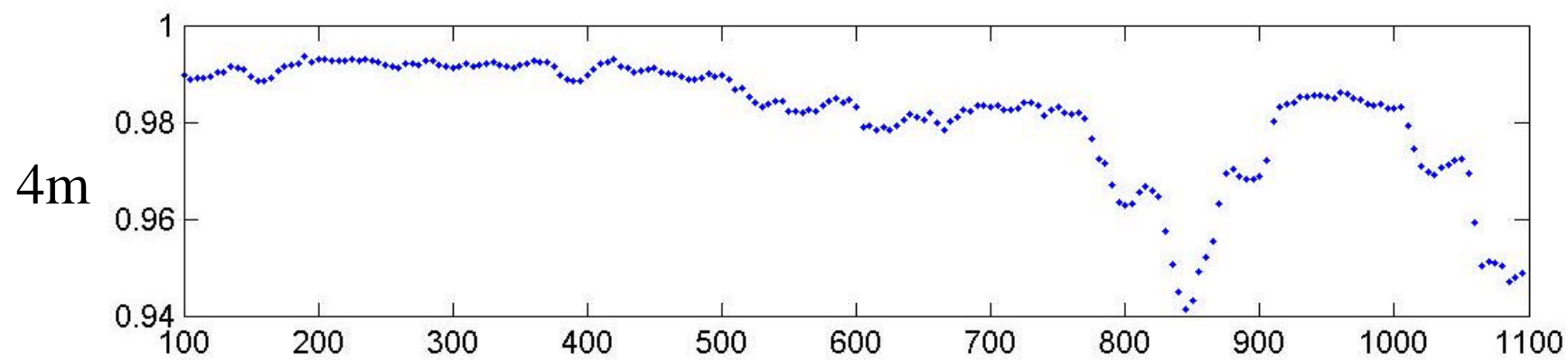




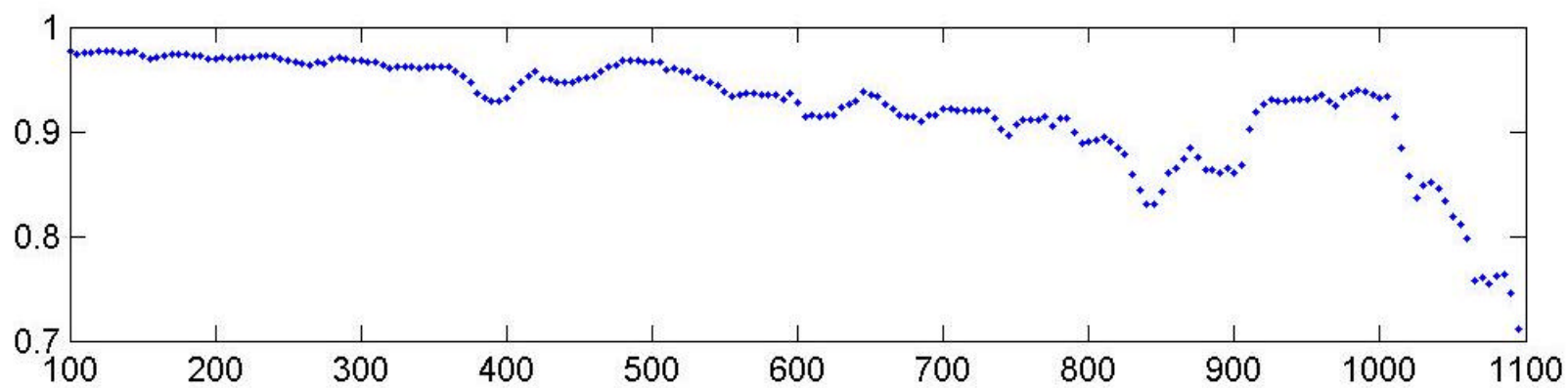


Focusing on a Signal Result on 30 Km

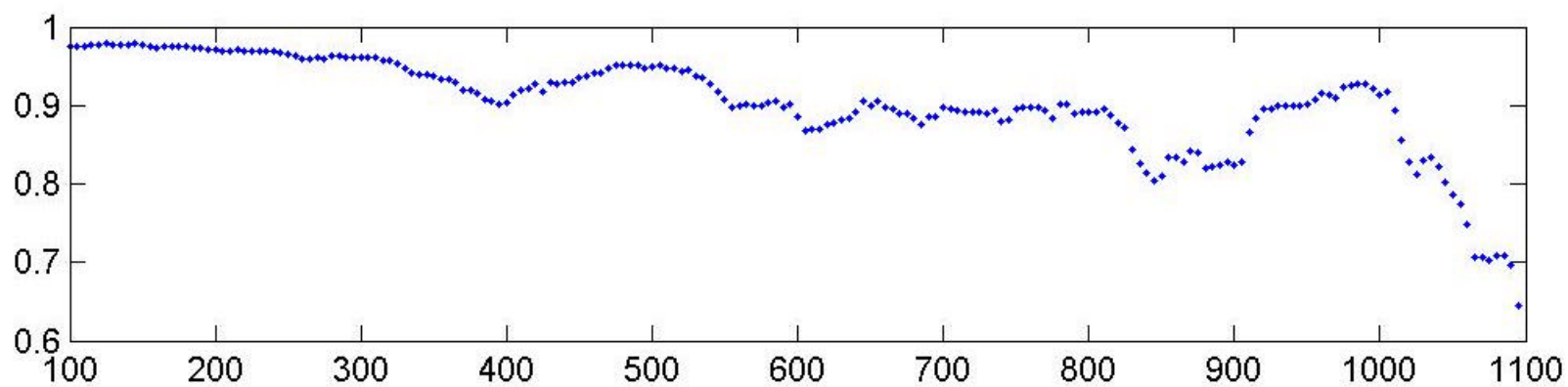
- **Horizontal coherence for different center frequency about different sensor space**



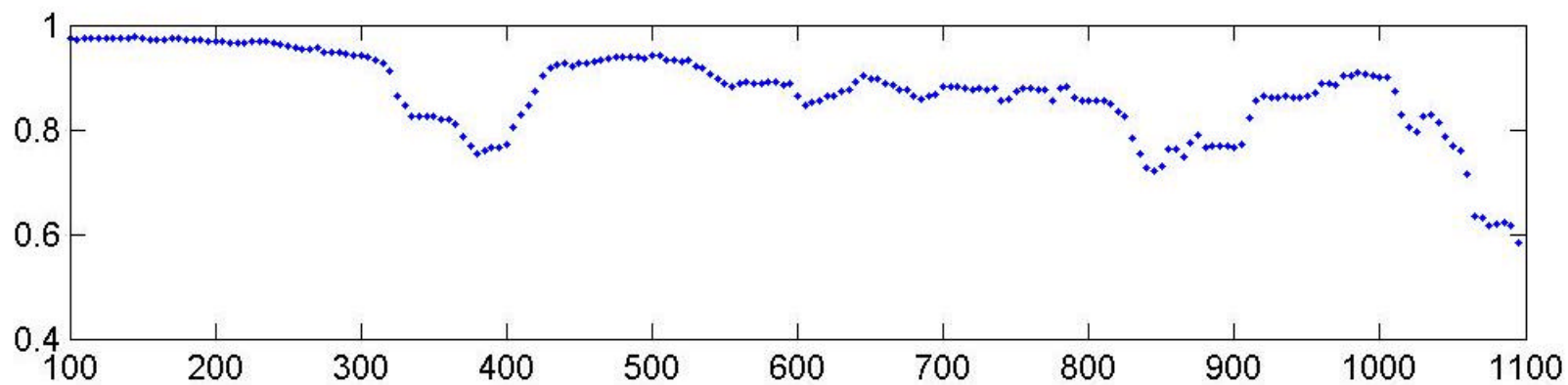
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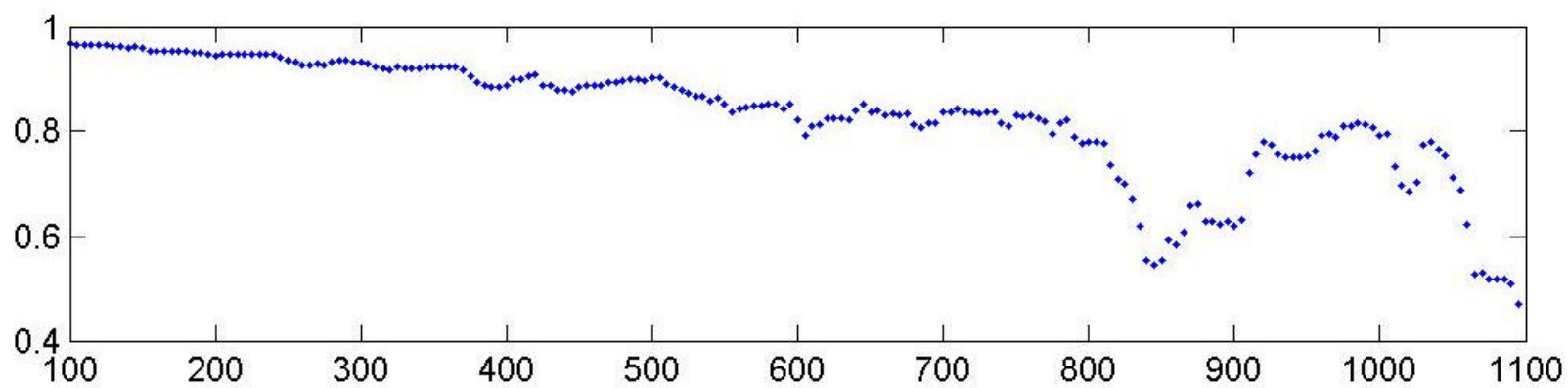
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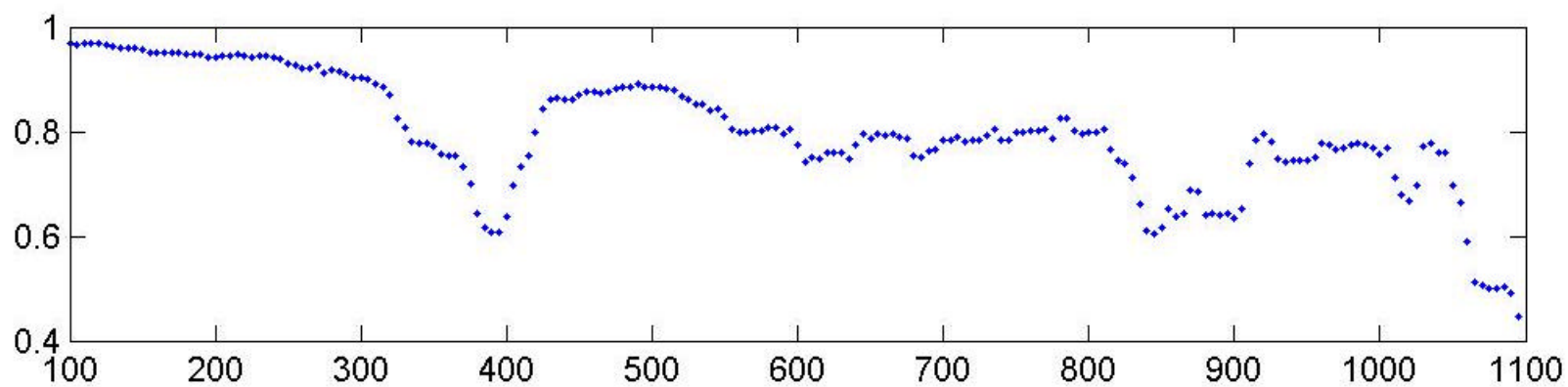
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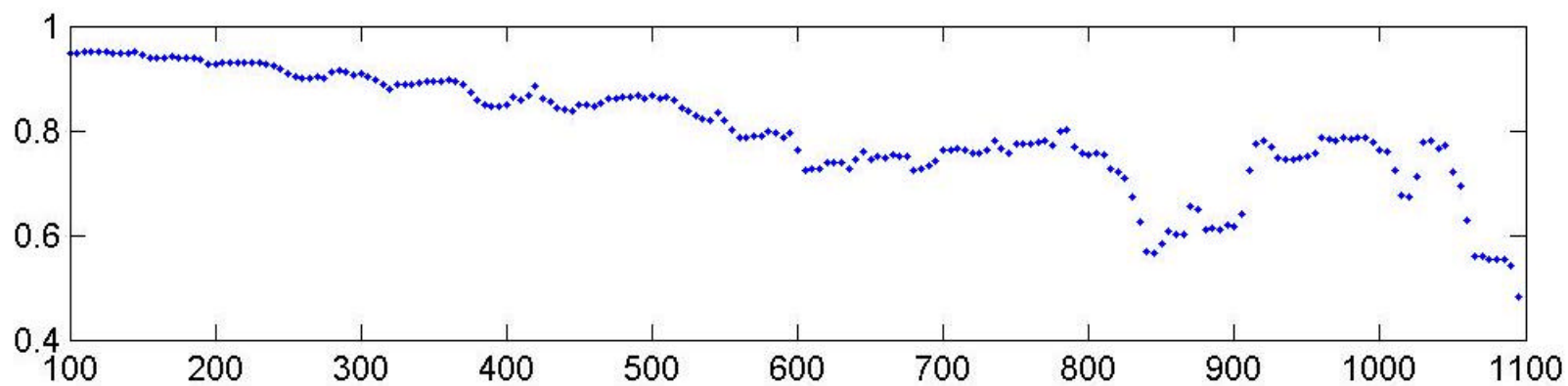
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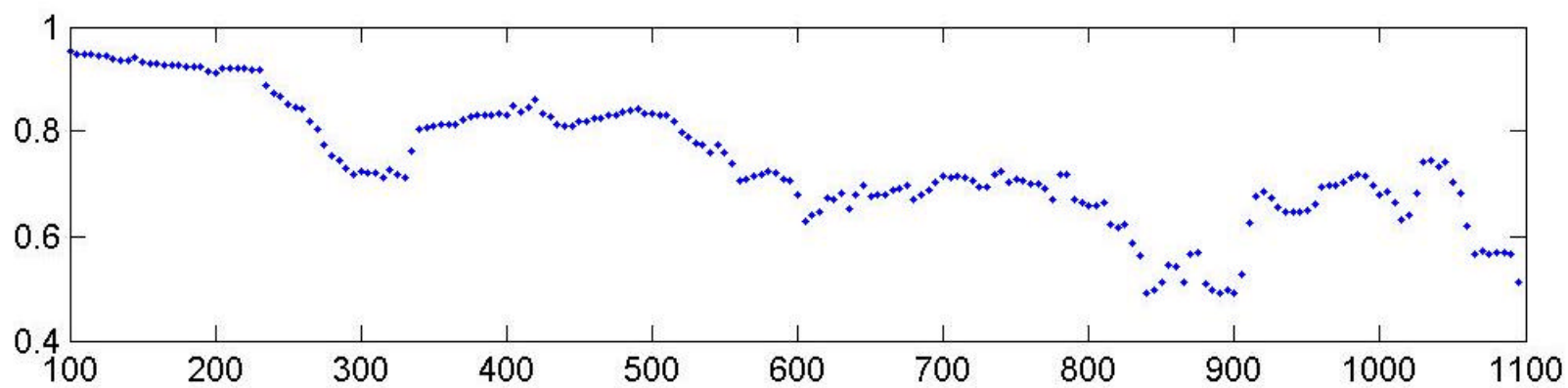
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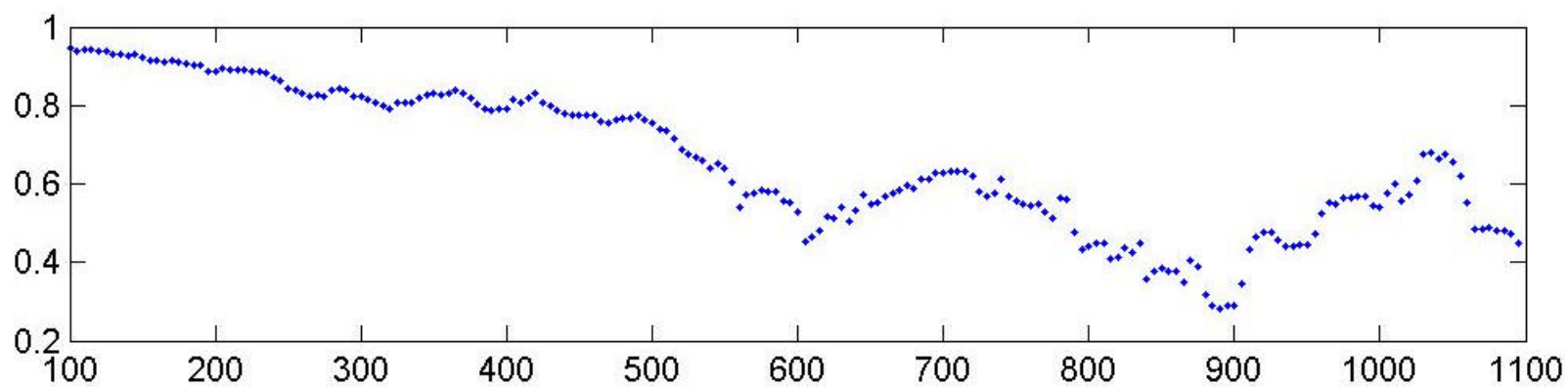
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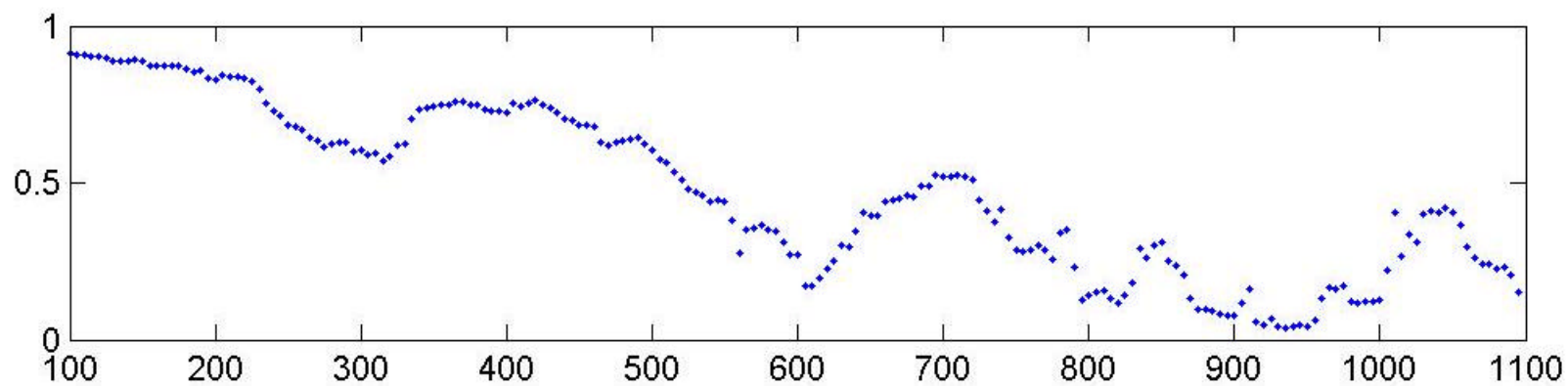
92m



100m

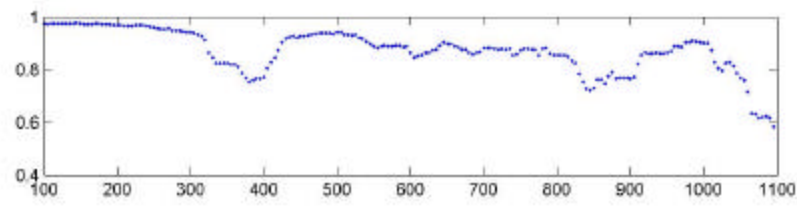
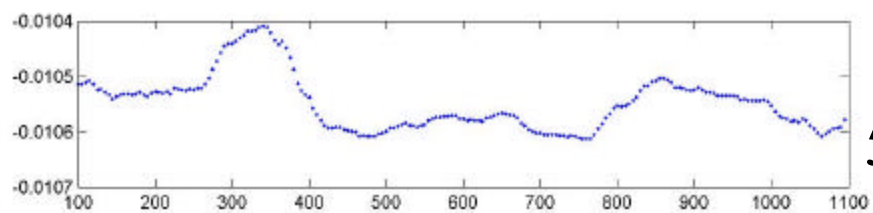
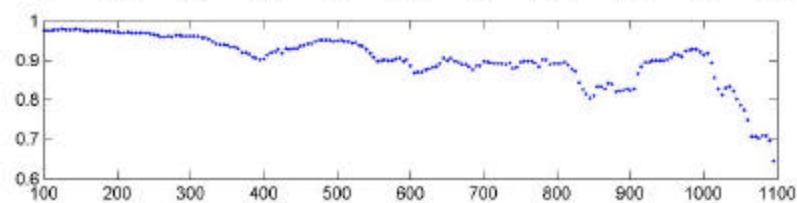
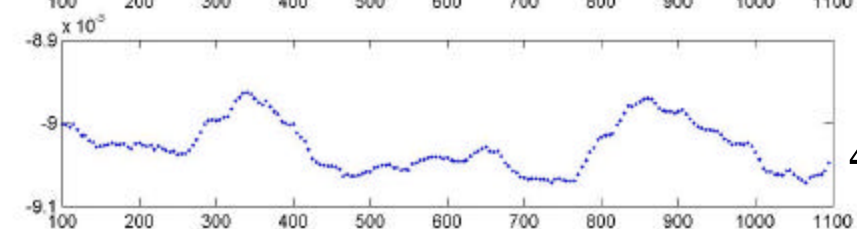
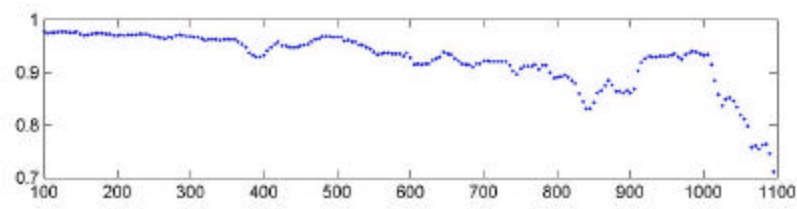
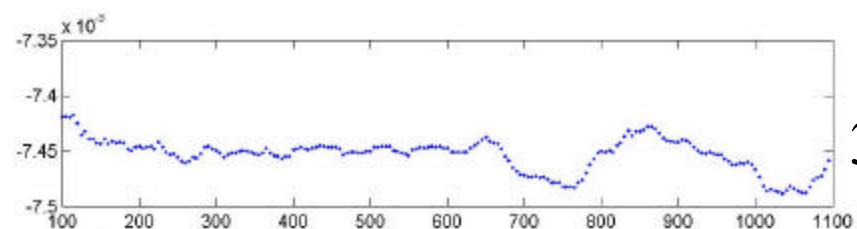
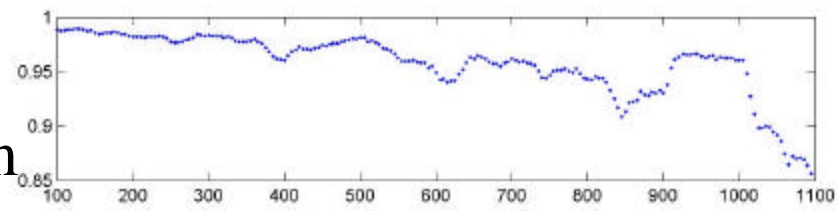
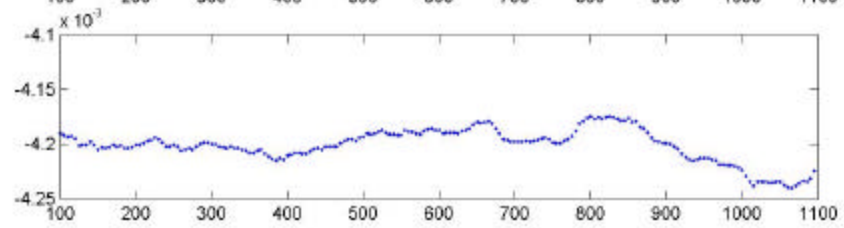
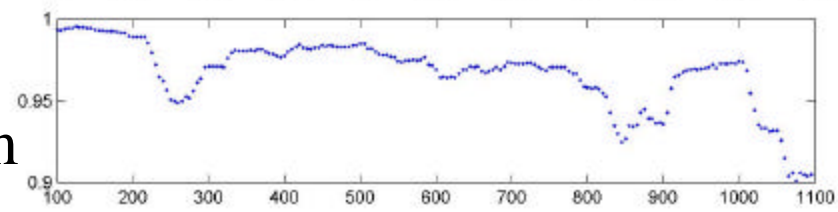
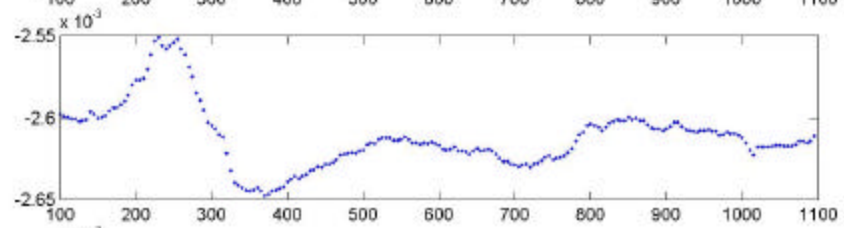
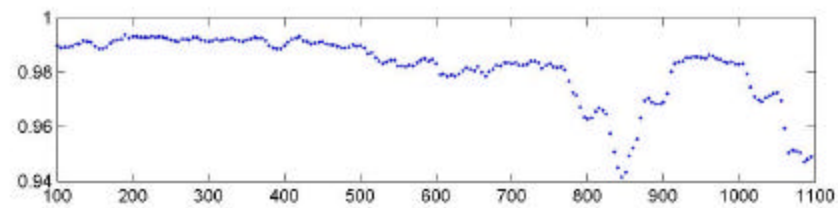
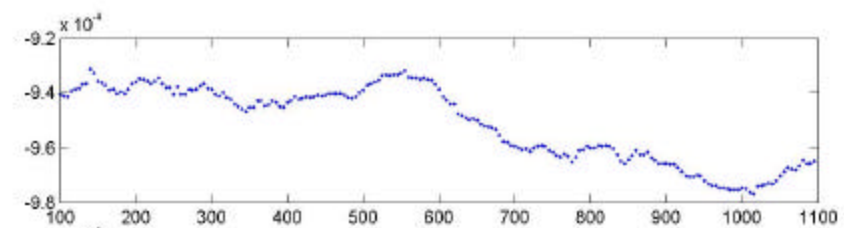


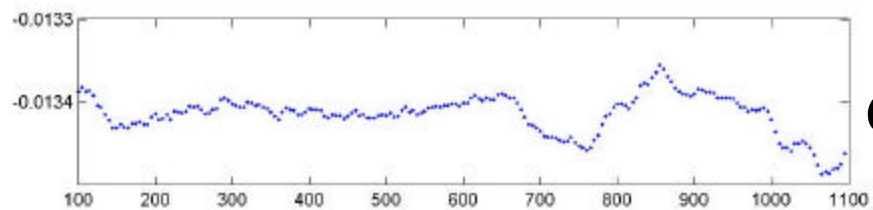
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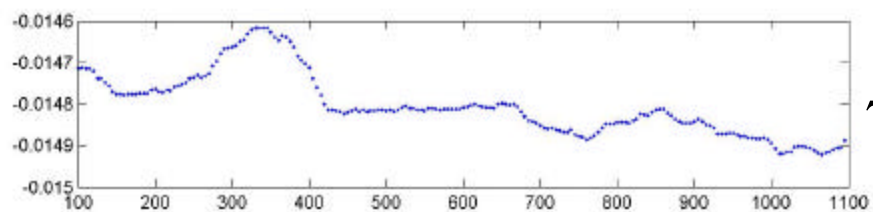
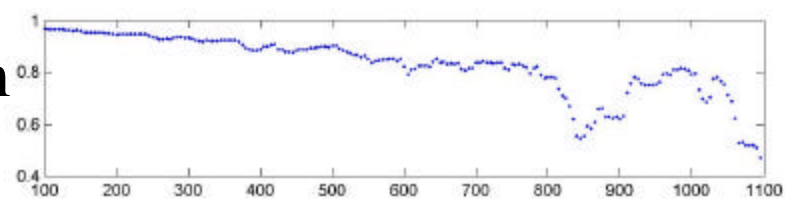
Focusing on a Signal Result on 30 Km

- **Compare the time delay and the coherence for different center frequency**

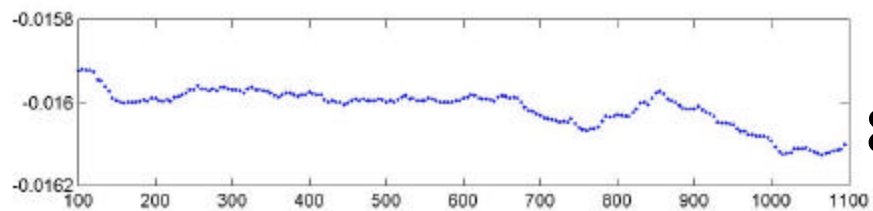
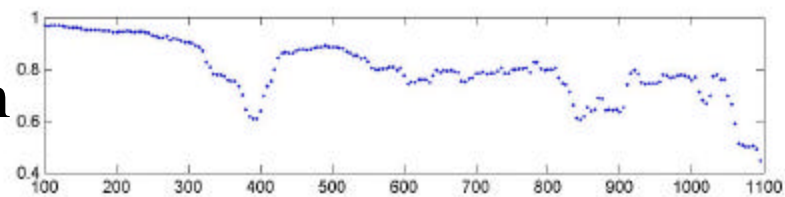




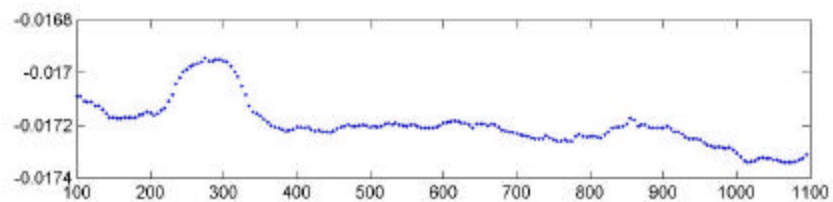
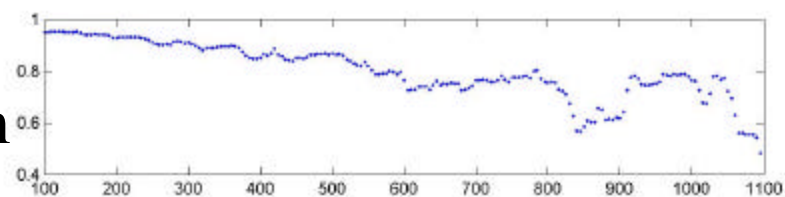
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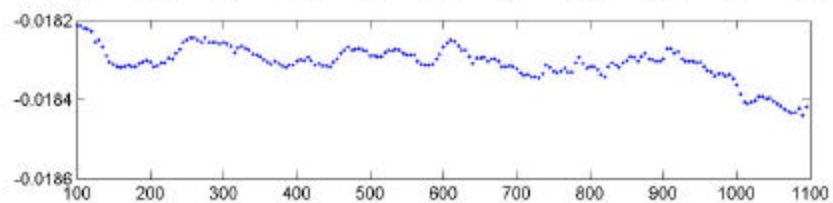
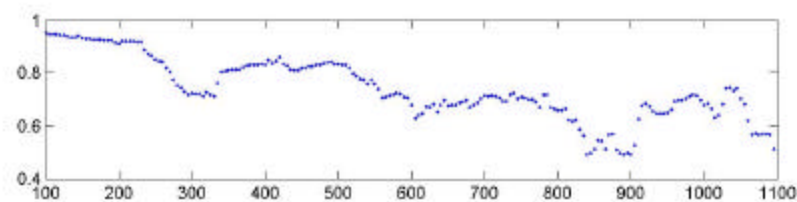
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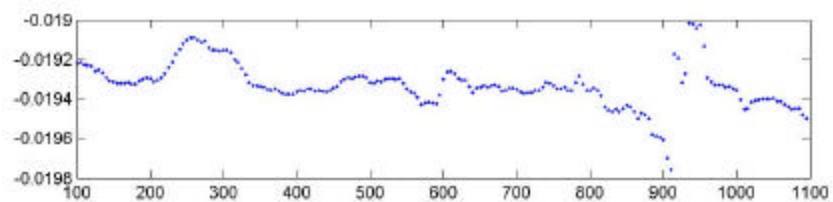
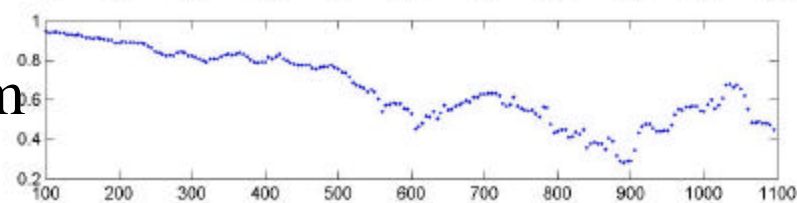
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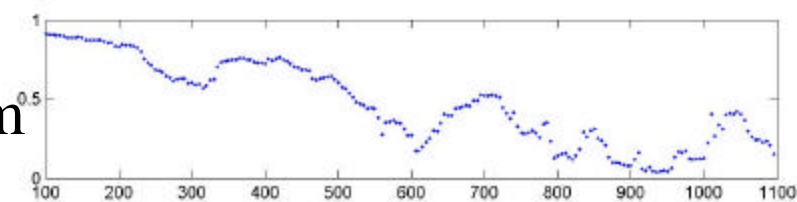
92m



100m

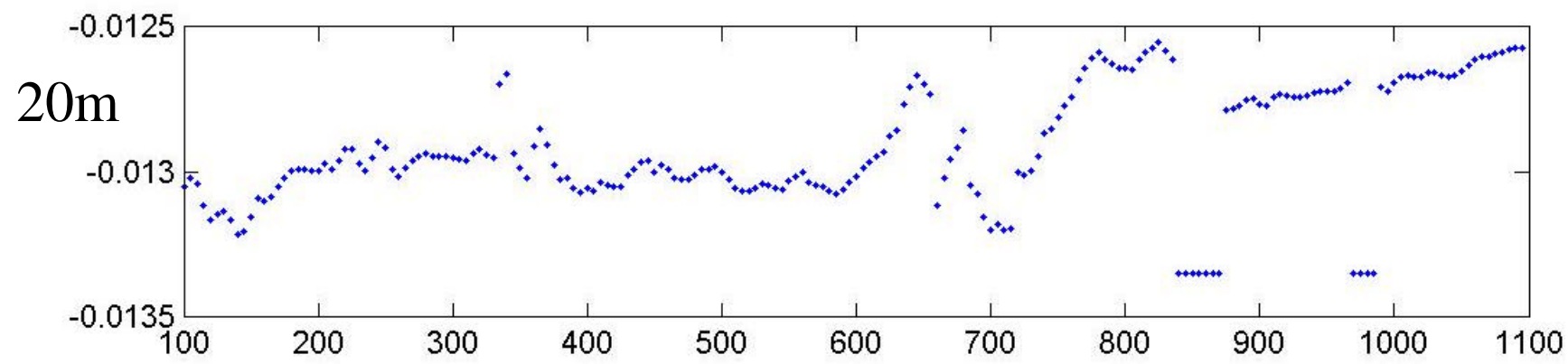
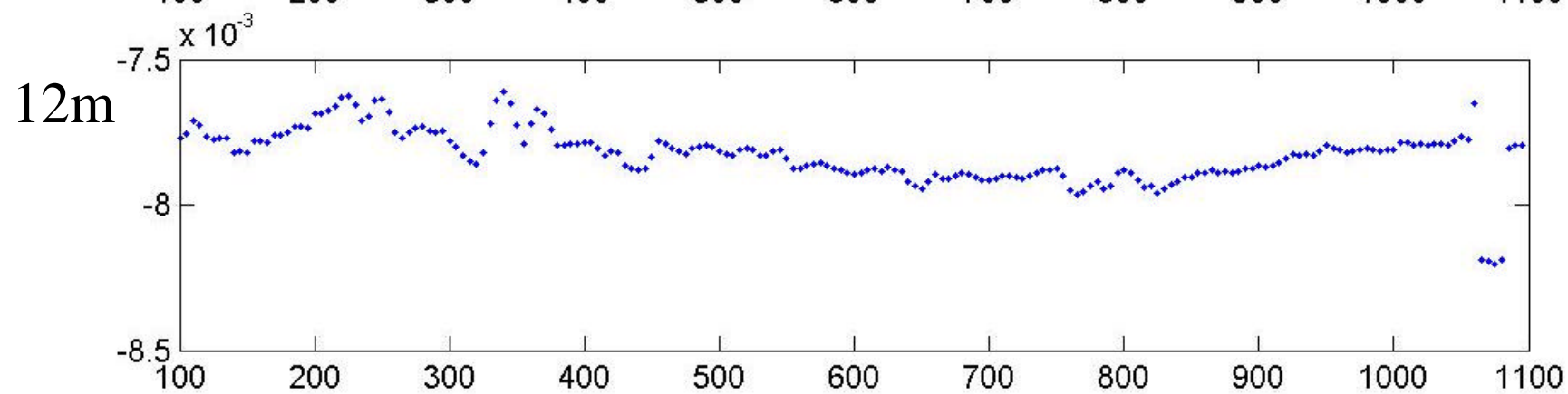
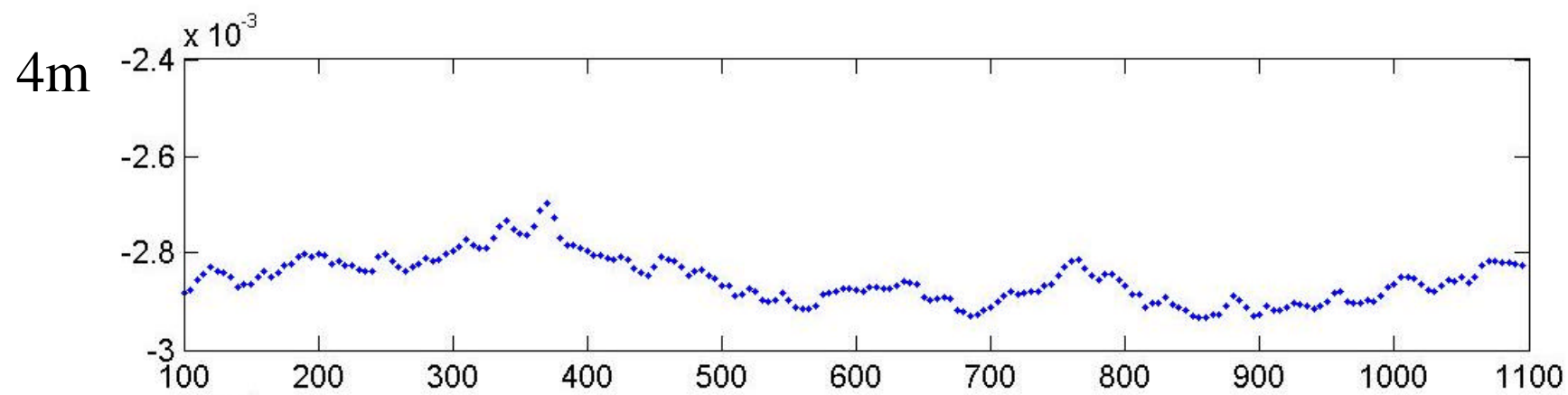


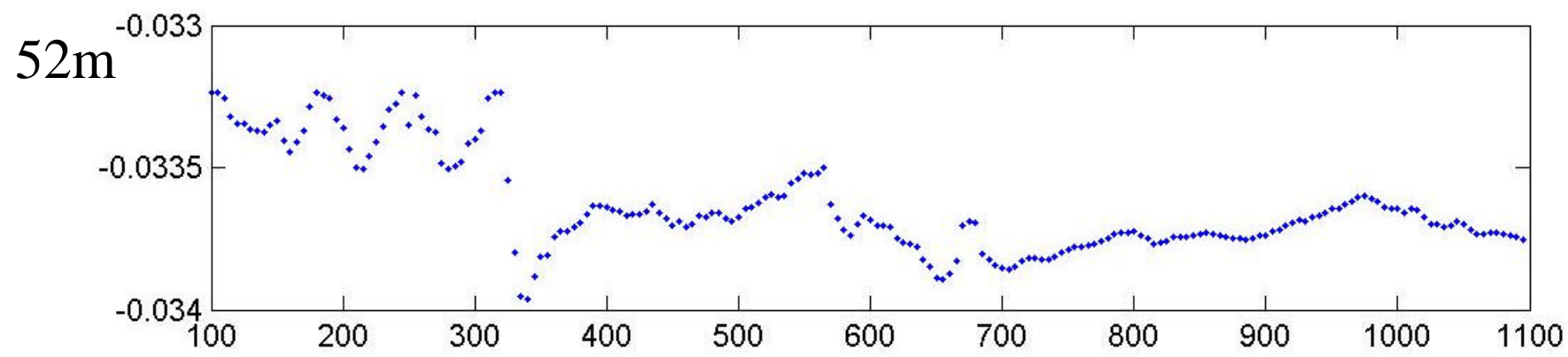
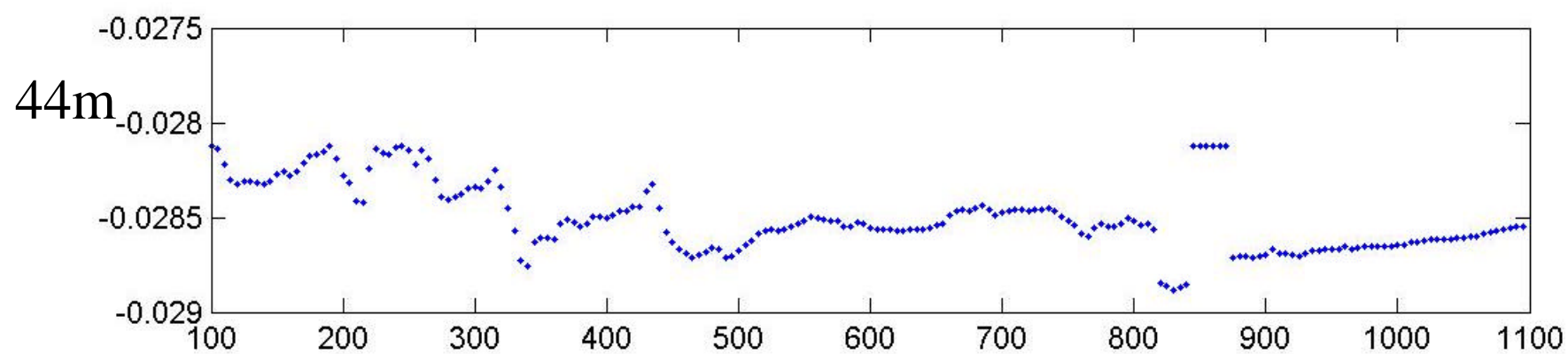
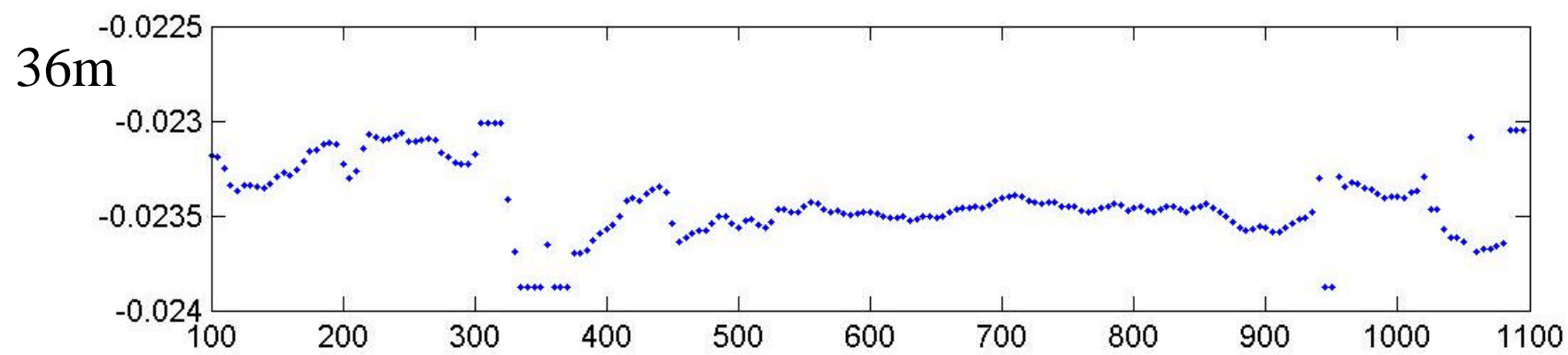
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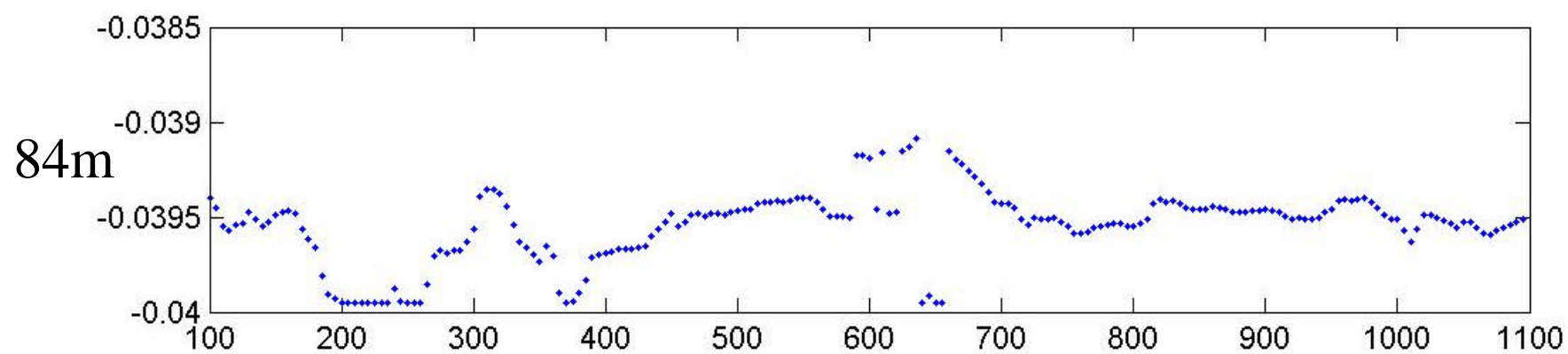
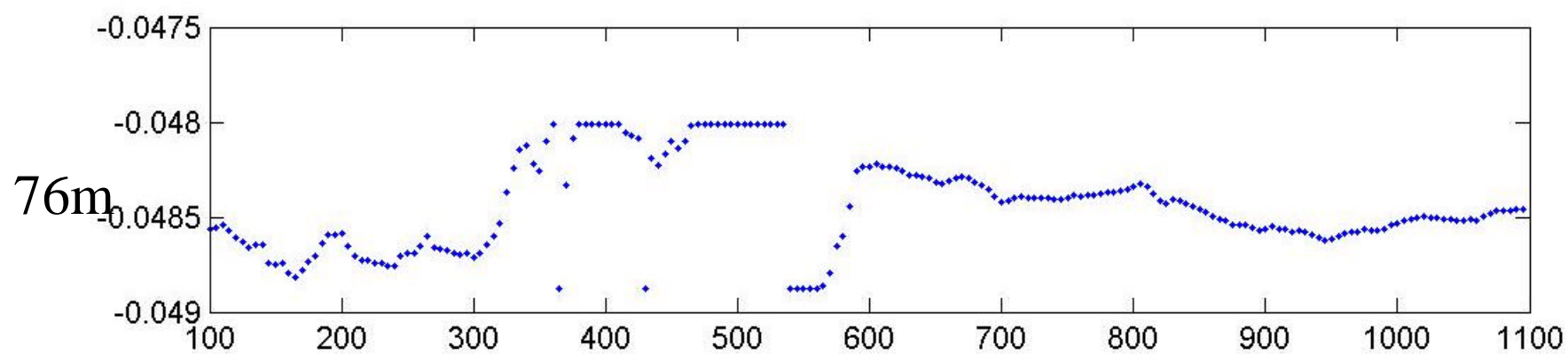
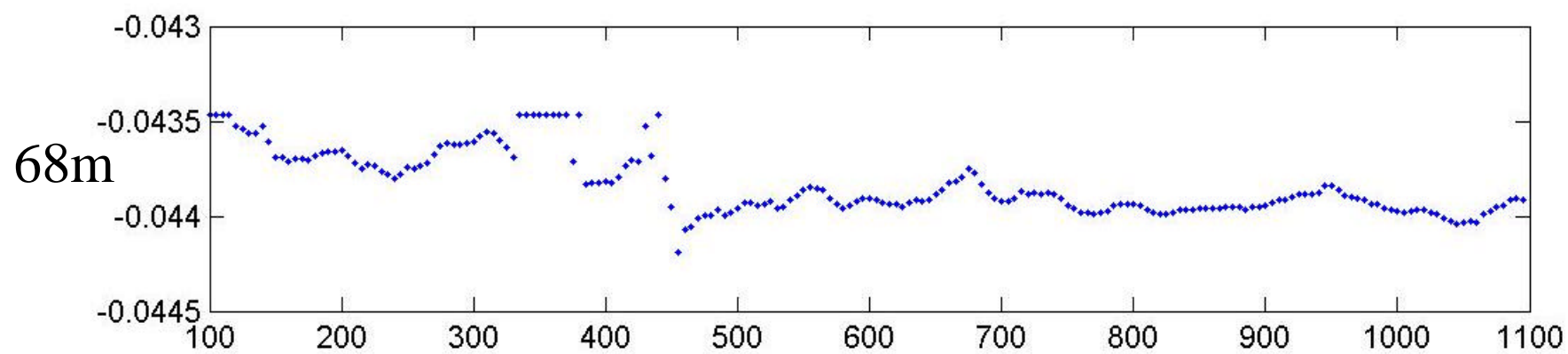


Focusing on a Signal Result on 3 Km

- **The ambiguity (grating lobe) occurred in the time delay estimation**







Conclusion (Preliminary ?) and the Further Work

- The time delay most time got less with the frequency grow
- The coherence for slightly delay time compensate changes only a little
- At some frequency, the coherence at every space goes down, make we guess that it is because of the source
- Some phenomena often occurs when the coherence at every space goes down

The Further Work

- **Calculate the time delay for each pair of sensors, at different center frequency, at different space, different range and different sources' and receivers' depth, using propagation model**
- **Analyze the affection of the variant of the propagation channel to the delay time estimation and horizontal coherence**

- **Find some useful experiment data of fixed point source and receiver, long time fluctuation. Since in the east china sea experiment, the bottom-mooring line array lost, and the south china sea experiment has also the corresponding data we need, and thus we would continue the data process for the SCS experiment fluctuation data.**